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THE Chemical Age

VOL. LXXII

4 JUNE 1955

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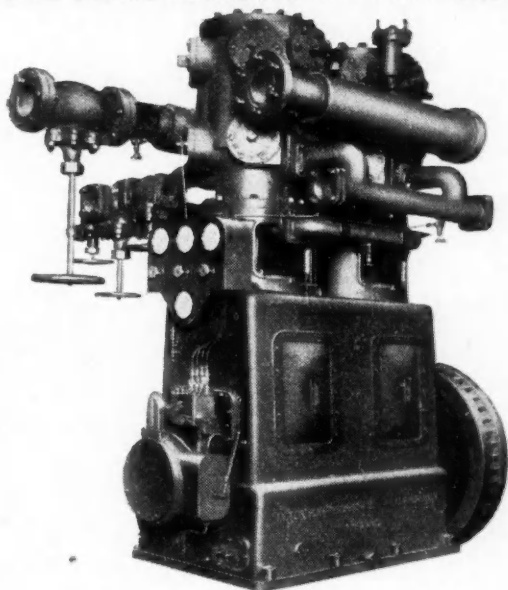


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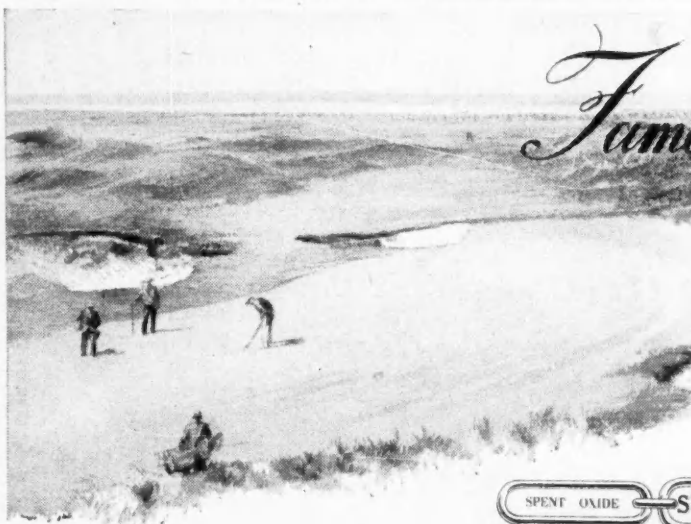


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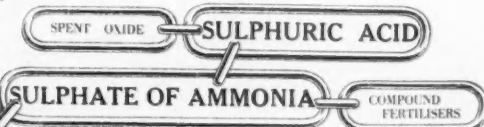


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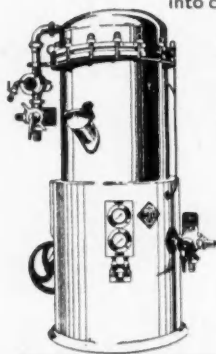
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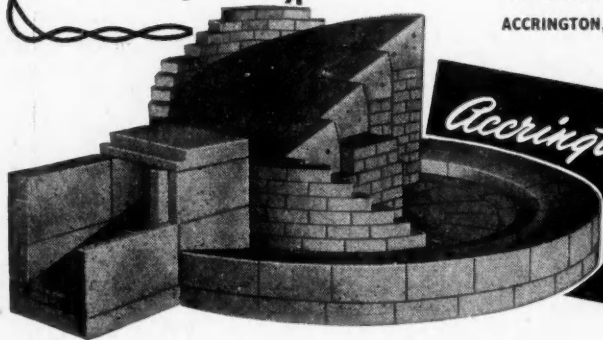
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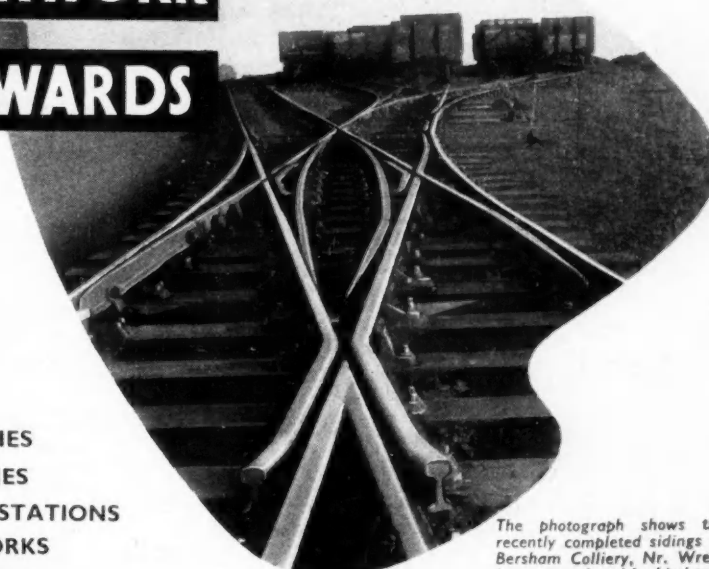


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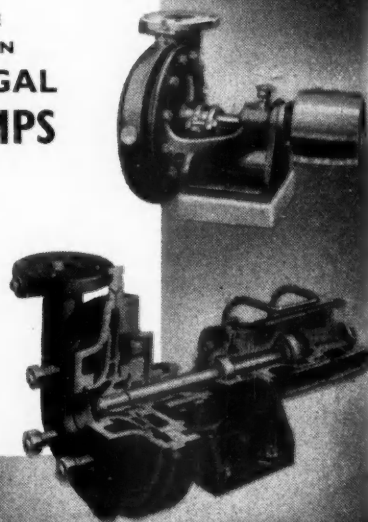
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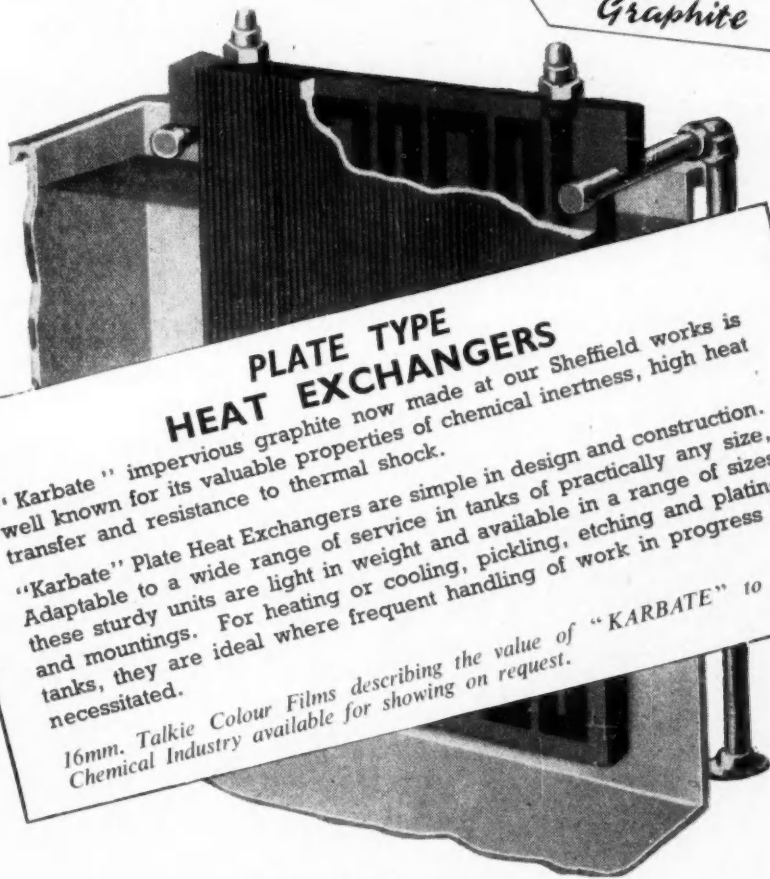
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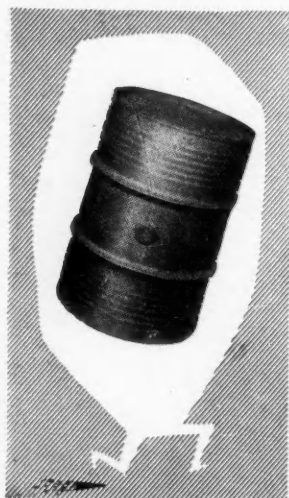
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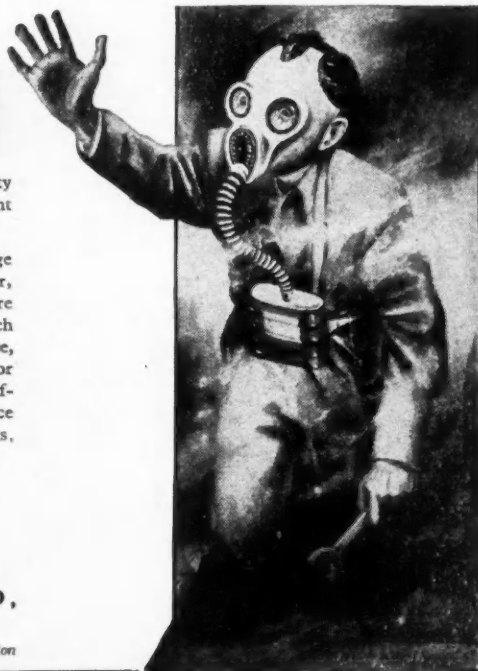
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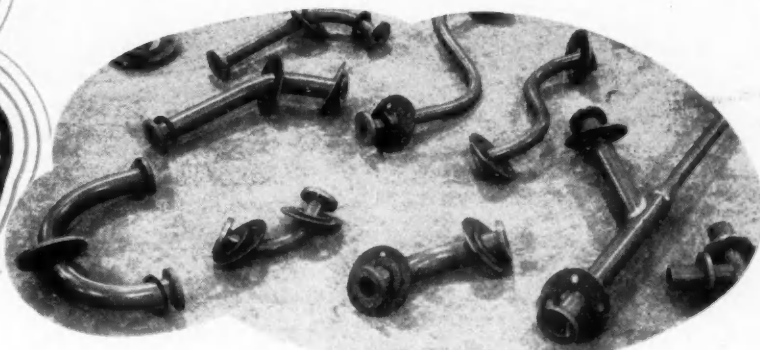
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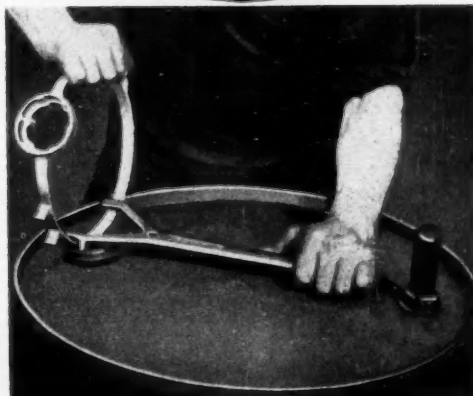
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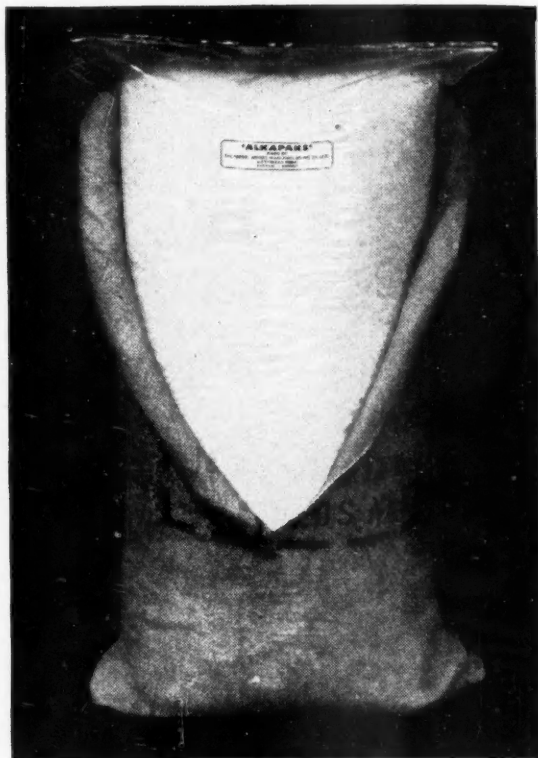
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Know-How Costings

A SET of papers on chemical economics first read at the annual meeting of the American Chemical Society has been published in *Industrial & Engineering Chemistry* (1955, **47**, 982). They attempt to assess the costs of process and product development; aptly enough, the general title was 'Know-How Economics.' It is doubtful whether any definitive assessment of these costs, even on the broadest basis, has been arrived at, but this could hardly have been expected. Industrial research costs have been soaring for a number of years and there is no reason to suppose that 1953 to 1955 represents a quietly stable period in which to take bearings. Most new processes or products involve increasingly complex operations, but the pressure exerted by this cost-raising factor varies from project to project.

It might be asked, 'why try to cost a generality of so many variations and uncertainties?' To this there are several answers. Even when accuracy cannot be reached in an assessment, the roughest sort of accuracy—so long as it is not inaccuracy masquerading as truth—is a better guide than none. Also, within the total costs of industrial development, there are different sectors of expenditure, and sometimes there are alternative methods of reaching the same target; these sectors can be usefully compared. Thirdly, if enough chemical companies are prepared to disclose project development costs, the examination of a number of examples can isolate some of the common factors of high expenditure.

For process development, the construction and operation of a pilot plant is a major cost factor. Pilot-plant research in US projects has sometimes cost more than \$1,000,000, and a six-figure cost is fairly common. To assume that a new process must always be operated initially on the pilot-scale may well be regarded today as economically unjustifiable. In most processing sequences there are reasonably familiar steps that need not be piloted; it may often be possible to ignore these in sub-commercial development. In some cases it may be cheaper to abandon the idea of a pilot plant altogether, proceeding with full-scale plant erection on the principle that changes made later will cost less than pilot-plant construction and operation. The necessity for a pilot plant depends upon the area of uncertainty in the design of the full-scale plant. There are cases when the main purpose of a pilot plant is to provide samples of the product for market-evaluation; can the high costs of small-scale operation always be justified for this single function? If it remains technically true that most new processes must still be approached along the pilot-plant route, examining the modern costs of this 'rule' does at least show that there are marginal cases in which the pilot stage can be discarded or operated only on a partial scale. When these economies can be reasonably risked, they offer not only savings in money but they are also likely to reduce the time-lag between laboratory production and factory output. In a competitive situation this

saving in time may be of inestimable value.

However, the extent to which the pilot stage can be avoided or reduced depends upon the area of uncertainty insofar as this can be predicted. This in turn depends, obviously enough, upon knowledge. A large company's past experience in process development may well represent a great capital asset, a storehouse of 'know-how' that can be drawn upon for new projects. By comparison, a small company or a young company is greatly handicapped. This is also true of countries. The more modern and highly developed a national chemical industry, the more likely it is that existent 'know-how' can save development costs. However, there is a limitation to the truth of this latter extension for it is valid only to the extent that companies are ready to publish their knowledge or to share it by what is now called 'know-how licensing'. To quote from one paper: 'If chemical industry would exchange more information through increased publication, duplication of research and development effort could be materially reduced'. There is plenty of food for thought for our own chemical industry in that single sentence. We ourselves have not infrequently deplored the lingering tradition of needless secrecy that still prevails.

The distribution of process 'know-how' sometimes takes national boundaries in its stride. Large companies with an international structure are frequently criticised as being politically undesirable or even dangerous; yet through such organisations the advanced 'know-how' of one country can be passed on at low cost to a branch or subsidiary unit in another country. Whatever views may be held on the subject of international articles or near-monopolies, the ever-increasing complexity of modern industrial chemistry may well justify this type of commercial organisation. Many modern processes are economic only if they can be financed and operated on a large scale; this in itself makes large-unit chemical businesses essential. The cross-linking of these large units is no less natural if specialised 'know-how' is to be shared. The cross-linking may take the form of producer-consumer relationship for some raw material; the

form of working association; or the open and direct form of merged ownership. Those who criticise these developments are, at any rate in the modern chemical industry, criticising natural evolution.

Obtaining process 'know-how' by licensing may often be the cheapest method of development. Sometimes, of course, patent rights make it the only method, but for the purpose of this discussion it is assumed that an alternative process could be developed by normal research. A licensed process is relatively cheap because it has been developed for ultimate use by a number of companies; each company bears only a share of the initial costs. Royalty rates cannot be excessive or the process is unlikely to be attractive to any potential licensees. In one of the US papers terms for I.C.I.'s polyethylene process are cited—the agreement includes immunity from suit, provides design data and technical 'know-how,' and offers instruction for operating workers. The royalty rate is said to be a lump sum payment of \$500,000 plus 2 per cent of the selling price of all polyethylene produced in the next 15 years. Some US companies licensing this process are outstandingly skilled in developing their own processes, and the fact that they have chosen the licensing route towards developing polyethylene production seems powerful enough evidence that this can often be the lowest-cost method. Another strong argument in favour of licensing both a process and its know-how is that it is virtually free from risk. Large expenditure is not faced until the process is in operation and income beginning to flow from it. By contrast, the effort to develop a process independently must involve heavy investment in research and pilot-scale development, yet some insuperable difficulty may prevent final success; or too much time may be taken and suddenly much the same process is developed by some competing company. The view is put forward in this particular paper that obtaining fully detailed 'know-how' by the licence method is frequently advantageous for even the largest companies, and for medium-sized or small companies it is almost essential, almost the only economic means by which they can keep up to date in a complex and highly competitive chemical age.

Notes & Comments

Fire Fighting

RESEARCH on fires and fire fighting can hardly be a subject of annual novelty; much of the latest (1954) Report from the Fire Research Board (HMSO 3s.) is a continuation story of the pattern of previous years. There are, however, one or two items that strike a fresh note. In studying the general problem of flammable clothing textiles, it has been found that nylon fabrics are not as safe as many people assume. Pure nylon fabrics hanging freely will not propagate flame for the nylon melts too rapidly; but this molten material can cause burns by adhering to the skin. This can occur whatever the weight of the fabric and even lightweight fabrics are not free from the risk. Open-mesh nylon fabrics or nets are almost as flammable as cotton if they have been stiffened with formaldehyde resins. It has been suggested that nylon fabrics dyed with inorganic dyes propagate flame as the metallic oxides left from combustion can form a matrix on which the nylon can burn; however, tests carried out with dyed samples have not confirmed this.

Wetting Agents Research

FURTHER research on the use of wetting agents in water applied to fires seems to have given small support to this idea. If the burning material is loosely packed the 'wet' water is no more effective than plain water. There is perhaps some advantage when closely-packed fibrous materials are on fire or smouldering. On this evidence it does not look as if surface-active chemicals can hope to develop much of a market with fire brigades. The development of static electric charges on petrol can be greatly minimised by the addition of 0.2 per cent of triethylamine oleate, which substantially reduces petrol's resistivity.

Unfortunately this additive precipitates in a few hours in petrol containing water unless there is agitation. However, when petrol is used as a solvent to form a paste, as in a number of industrial processes, the additive remains in solution and pre-

vents the accumulation of static charges.

Bursting Panels

PANELS that will burst under pressure and act as vents for dust explosions have been investigated and three materials studied to date are polythene film, cellulose sheet, and kraft paper treated with a fire-retardant. Results of tests seem to have been hopeful but not altogether consistent. The need is for thin panel materials that are more brittle yet more flexible for handling. As the physical properties of polythene can be varied (e.g., by irradiation), there may be a field here for specially prepared polythene. Polythene has the advantage that it will melt in the presence of flame. The ideal preventative for a dust explosion is an open vent; a dust-enclosing panel that will burst under developing explosion pressure is needed if dust control and dust explosion control are to be jointly secured.

Chilean Nitrate

FOR much of the first decade of this century the principal world source of nitrogen was the nitrate deposits of Chile—on these all countries' needs for explosives and fertilisers mainly rested. At the end of the nineteenth century Crookes made the semi-Malthusian prediction that the bread-eating nations were doomed if some other source of nitrogen was not developed before Chile's vast stores were exhausted by the huge annual withdrawals. By-product nitrogen from coal carbonisation processes could only help to balance the nitrogen supply-demand budget. The picture was soon transformed, of course, by synthetic fixation. Today, according to a recent article in the *New York Times*, the Chilean nitrate industry is in a far from healthy state. It is said that it cannot operate profitably much longer unless new capital investments are made; but Chilean laws discourage foreign capital injections. The equipment in use is elderly or obsolete. The newest shovel is over 10 years old; the major plant for graining and

crystallising is 25 years old. Steam engines bought from Russia after World War I are still in use. Nevertheless, the vast modern development of synthetic nitrogen has not put Chilean nitrates out of business. In 1954 some 1,500,000 tons of sodium nitrate were produced and exports were made to 41 countries, worth about £15,000,000 in foreign exchange to Chile. The one-time monopoly in nitrates is still supporting about 5 per cent of the world's nitrate usage. Any fears that demand would exhaust Chile's nitrate resources have vanished; in any case, apart from the technological transformation of the nitrogen industry, the Chilean deposits are now known to be far more extensive than originally thought.

National Management ?

THE uncertain state of Chilean politics seems likely to prevent any early improvement in the atmosphere for foreign investment. Exchange rates are unrealistic, allowances for depreciation are inadequate. The Government takes 25 per cent of the gross profits made by the nitrate industry, but a recent attempt to improve conditions so that fresh investment would be attracted was accompanied by an increase in this 25 per cent 'tax' to 40 per cent. This change has not, however, been passed into law, nor does it seem likely to be passed in the near future. Few 'natural' products have had to stand such fierce and large-scale competition from 'synthetic' competition. If an industry that has still been able to hold quite a significant share of world trade despite this competition declines needlessly through plant obsolescence and lack of capital, it will surely be a tragic piece of national mismanagement.

Achema XI

Final Figures Show Many Records

THE ACHEMA XI—chemical apparatus and equipment congress and exhibition—which was held in Frankfurt from 14-22 May in connection with the European Convention for Chemical Engineering, surpassed all previous ACHEMAS both in size and attendance. Since the exhibition closed the organisers have been busy compiling statis-

tics and their latest report shows that the figures we have quoted previously were an understatement. The number of exhibitors, for instance, was 850 and not 750.

The large number of foreign visitors was particularly gratifying to the organisers. No less than 49 per cent of the 12,150 visitors registered by name were from countries other than Germany and these came to Frankfurt from 52 foreign countries. The number of foreign exhibitors at ACHEMA XI was more than three times the number of those exhibiting at ACHEMA X in 1952. Thirty-seven firms from 10 different countries were present in 1952 but this year no less than 106 firms from 13 different countries exhibited. The actual number of exhibits exceeded 6,000. The large number of foreign students attending the ACHEMA XI Lecture Course—some 800—was also remarkable.

At Frankfurt the opinion was frequently expressed that the duration of the exhibition and convention was not long enough to enable all the available material to be properly assimilated and that consideration should be given to the possibility of extending the duration of the next ACHEMA which will probably be held in 1958.

Furthermore, it was apparent that the technical equipment of the exhibition halls at the Frankfurt Trade Fair Grounds would need to be increased in order to meet the heavy demands imposed upon it. This applied particularly to the crane power available as well as to the various power lines and circuits. This matter is already under discussion with the management of the Frankfurt Trade Fair.

Industrial Deaths & Disease

IN April 116 industrial workers received fatal injuries at their work. In the chemical trades five people lost their lives. These figures, just released by the Ministry of Labour, show that deaths from industrial accidents were three more than in March, and nine more than in April last year.

The number of workers contracting industrial diseases during April was 47. Of these 26 were cases of chrome ulceration (17 in the manufacture of bichromates and nine from chromium plating). Among workers with pitch and tar there were 15 cases of epitheliomatous ulceration (skin cancer) reported.

Pest Control Work in Britain

Research Report for 1954

BULK storage of grain and other food-stuffs is likely to decrease in this country as a result of the almost complete disappearance of bulk purchase and government ownership. This would affect the relative importance of infestation problems on the research programme of the Pest Infestation Laboratories, states the annual report, 'Pest Infestation 1954,' published by the Stationery Office, price 3s.

Nevertheless, at some time in the future this country might want to store food on a large scale, and for this reason research on the disinfection and protection of grain held in store must continue. Also, many Commonwealth countries are interested in long-term storage for famine reserves, and the laboratory is continually meeting new problems or variation of old ones in this field.

There has been no tendency to restrict the work of the laboratory to the problems which are solely and immediately concerned with the welfare of the UK. The Pest Infestation Research Board feels that the laboratory should play its part in the conservation of the world's crops from destruction by pests. Any effort to assist countries will have an effect far beyond the point of application. Improvements which may result from such assistance are not only of local benefit, but are reflected in the quality of imported foodstuffs, on which Britain so largely depends. Benefit is also felt by food manufacturers and processors in this country, whose exports must maintain a high standard of freedom from contamination by insect fragments or rodent hairs.

Bio-assay of Pyrethrum

A method for the bio-assay of pyrethrum by weight loss from flour beetles, *Tribolium castaneum*, has been developed and a description has been submitted for publication. The weight loss of pyrethrin-treated beetles appears to be principally a loss of water vapour through the spiracles. However, the relation between oxygen consumption and loss of weight is complicated, and it may be that some other factors supervene, such as, perhaps, spiracular paralysis.

An improved photometric version of the

chemical assay of pyrethrum by the 2:4-dinitrophenylhydrazine method has been derived. Tests on a series of pyrethrum and allethrin standards and concentrates indicated that the new method was consistent, accurate, and applicable to both types of insecticide. The standard mercury-reduction method was found to give high results, the margin of error ranging from 10 per cent on pure materials to 50 per cent or more on crude oleo-resins.

Model Compounds Synthesised

It would be of interest to determine the optimum molecular requirements for insecticidal activity, and the synthesis of a number of model compounds has been undertaken with this end in view. Valone (2-isovaleryl-1:3-indandione) and related compounds have unusual insecticidal properties and there are indications that this may be associated with the β -triketone group. It seems that a ring-keto structure is essential.

Fumigation of bagged flour with methyl bromide has been shown to have no effect on the baking quality, but, unfortunately, a slight foreign smell might be detected in the freshly cut loaves. In general the tendency has been to avoid the use of methyl bromide with flour intended for baking, but recently there has been a renewal of interest in this problem and it was decided to carry out tests to decide whether the taint produced is of commercial significance. Sacks of flour were exposed to both high and low concentrations of methyl bromide and samples of the flour were then sent to four independent research laboratories where loaves were baked and tested using an agreed procedure. It was concluded that no taint of commercial importance was present in any of the samples.

The detection and estimation of halogenated hydrocarbons in the air is important in any study of fumigation. Unfortunately, there does not appear to be a completely suitable method available. The most accurate instrument is of American manufacture and uses the same principle as the ordinary halide lamp. An arc struck between copper and platinum electrodes varies

in colour according to the amount of halogen compound present in the atmosphere. This instrument is almost certainly too costly for the commercial fumigator.

Concern has been expressed about the use of certain insecticides, 'not because they necessarily present any greater hazard, but because information does not exist on which to base an estimate of the risk they constitute'. As a consequence of this statement, which was made in a recent report on toxic chemicals, work is being done on the nature and significance of insecticide residues in foodstuffs. It has been found that methyl bromide at the concentrations normally present after fumigation would have no practical effect at all.

Aluminium Centenary

Exhibition at Festival Hall

ONE hundred years ago, in 1855, Michael Faraday was able to show members of the Royal Institution the first sample of aluminium to be produced in the United Kingdom. To mark the anniversary of this a Centenary Exhibition is being held by The Aluminium Development Association at The Royal Festival Hall from 1-10 June.

In 1855 less than two tons of aluminium was being produced annually in England at a price of nearly £3 per lb., and when the electrolytic reduction process of Héroult and Hall was put into operation in this country in 1890, output rose to 5 tons per day and the price dropped to 5s. per lb. Total production to-day is some 300,000 tons and the price of ingot is under 1s. 6d. per lb. The exhibition briefly traces the history of this metal during the period and then goes on to show the wide uses it has in this, 'light metals age'.

The exhibition is divided into 14 sections—12 showing the principal uses of aluminium and the other two being devoted to history and properties and research. Visitors are being shown applications in the aircraft, road transport, various consumer goods, marine, railway, packaging, building, structural engineering, chemical engineering, general engineering, electrical engineering and agriculture and food industries. In the chemical engineering section there are 12 exhibits.

The principal advantages of aluminium in chemical engineering are its high resistance to attack by a wide variety of chemicals and

its ease of fabrication. Generally, aluminium of not less than 99.5 per cent purity is used, although where high strength without undue loss of corrosion resistance is important, it is alloyed with manganese, magnesium or magnesium and silicon, etc. All the common wrought forms are available—where necessary in very large sizes.

Recent and revolutionary advances in the joining of aluminium by argon-arc welding, and self-adjusting arc-welding have aided immeasurably in the construction of chemical plant as these methods do not involve the use of flux, and give particularly neat welds which—where necessary—can be readily dressed. Large riveted joints may now also be made without difficulty and brazing is commonly applied by flame, flux-dip or furnace methods.

An indication is given of the versatility of the metal in exhibits varying in size from packing rings for towers to typical pipe-work fabricated by argon-arc welding. Castings are represented by filter press parts, accessories for a road tanker, and the bodies of such items as a colloid mill and a high speed mixer.

A fairly recent development is the use of corrugated sheet to cover insulation on pipes: both protection and extra thermal insulation are provided. Heat exchangers are vital parts of the many chemical processes and a high pressure contraflow brazed aluminium type is one of the exhibits. The chemical engineer selects his bursting disc to suit his process and several are shown made from aluminium foil or sheet.

The firms co-operating in the section are Corrosheath Ltd., Premier Colloid Mills Ltd., The Hydronol Syndicate Ltd., Warren Morrison Ltd., A.P.V. Co. Ltd., I.C.I. Ltd., Marston Excelsior Ltd., The London Aluminium Co. Ltd. and British Filters Ltd.

Stork Laboratory

Sir Geoffrey Heyworth, chairman of Unilever, opened the new laboratory at the Stork margarine factory at Purfleet, Essex. Costing about £20,000, the laboratory can produce an English winter or a tropical summer in the constant-temperature room, which can be thermostatically controlled at any desired temperature. Another feature is an apparatus designed at Purfleet which enables the quality of oils to be assessed by a laboratory refining technique.

IG Farben Successors Prosper

Increased Interest in Production Ventures Abroad

ANNUAL reports for 1954 now published by the three big IG Farben successors confirm the impression that the past year was highly successful for them. Their combined sales rose by 20 per cent to DM. 3,387,000,000 to which exports contributed DM.1,160,000,000, an increase by 25 per cent. Bayer and BASF placed 37 and 36 per cent of their total sales abroad, Hoechst, which did not score quite as large export gains as the other two companies, 30 per cent. The three companies together accounted for 40 per cent of all chemical exports from the Federal Republic.

For the current year all three expect a further substantial increase in export sales, not only because of the good results of the first quarter of the year but even more on account of the large investments last year which now begin to bear fruit. Foreign sales organisations have been extended. It has been shown, however, reports Farbwerke Hoechst, that a successful export business increasingly depends on support by manufacturing facilities of one's own in foreign countries. Hoechst has therefore acquired a majority interest in the Metro Dye stuff Corp., in the US, and has begun to build, in conjunction with G. R. Grace & Co., a chemical factory in Brazil which will produce chlorine, alkalis, solvents, textile chemicals and pest control agents. Hoechst has also announced the existence of 'concrete plans for manufacturing activities in Spain and Argentina'. Badische Anilin- und Soda-Fabrik likewise intends to 'participate very soon in certain manufacturing projects abroad'.

Larger Capital Expenditure

With most sections of the German chemical industry employed to their full capacity, capital expenditure last year, when the three companies invested a total of DM. 494,000,000, was dictated by the need to eliminate bottlenecks and provide additional plant capacity in the most swiftly advancing sections, notably for chemical fibres and plastics and intermediate products for them. BASF last year started on a comprehensive investment programme which will require even larger capital expenditure in the near future and is scheduled for completion by

1957. This programme, it is stated, is intended 'not only to produce efficiently products of improved quality and thus to strengthen the profitability of the company but to associate the name of BASF with the pioneering achievements of chemistry'.

Above Average Exports

Bayer last year concentrated in its investment policy on eliminating bottlenecks, improving the efficiency of existing plant and starting new productions. The starting-up of plant for isocyanates and polyesters was partly responsible for the above-average increase of the company's exports, and in the current year the new synthetic fibre installations are to be run at full capacity. The extension of other sections is also to be pressed forward. Hoechst, like the other two companies, paid special attention to plastics and fibres, and also to antibiotics and, among basic chemicals, to carbide and phosphorus. The oil cracker now under construction at Hoechst will use a cracking process developed by the company which has proved fully practicable on a technical scale. Partly based on natural gas from the Darmstadt area on which BASF is also drawing, the cracking plant at Hoechst is expected to come into operation before the end of this year. A pilot plant for making Diolen, the company's brand of polyester fibre, has been in operation since the end of 1954.

In the pharmaceutical field Hoechst has opened a streptomycin unit and, through its Bering subsidiary, developed an anti-polio-myelitis serum which is now being tried out on human beings. The dyestuffs business developed favourably in spite of a slight recession in the German textile industry, largely as a result of greatly increased exports which are at least partly attributed to increasing attention to colour in many industries and countries. Very good results were also achieved last year in the field of agricultural chemicals; further substantial advances are anticipated for pest control agents while the fertiliser trade did not develop quite as favourably as other sections.

The rapid extension of production facilities has necessitated appropriate financial

measures. BASF proposes to raise the share capital from DM.340,000,000 to DM. 510,000,000 while Hoechst has increased its share capital from DM.286,000,000 to DM. 385,000,000. Bayer states in the annual report that the envisaged investments cannot be financed completely out of the company's own resources and that the provision of further capital and funding of debts is receiving special attention.

In spite of the financial strains caused by the rapid expansion, all three IG Farben successors view the outlook with great confidence and anticipate a further swift increase in sales both at home and abroad. While leading German manufacturers now keep in step with foreign producers, it is pointed out that compared with pre-war days Germany had fallen behind. The Federal Republic now supplies six per cent of the world production of chemicals, compared with some 15 per cent before the war.

Copper & Zinc Production Down

WORLD smelter production of copper (excluding secondary production) fell by approximately 9,000 tons last year and totalled 2,704,400 long tons according to the British Bureau of Non-Ferrous Metal Statistics. This included an estimated production of 334,000 tons in the Soviet sphere compared with 331,500 in 1953. The production in the rest of the world totalled 2,372,449 tons compared with 2,384,235 tons in 1953.

In the US, the largest producer, output fell by 91,000 tons, but there were increases in many countries, notably Canada and the Belgian Congo. Output of the five foremost producers last year, with the 1953 totals in brackets, was:

US	844,533 tons	(935,545)
N. Rhodesia	345,748 ..	(340,259)
Chile	333,750 ..	(331,915)
Canada	234,188 ..	(191,862)
Belgian Congo	216,450 ..	(205,918)

Despite the fact that slab zinc production in the US fell by approximately 90,000 tons, world production increased by 41,000 tons to 2,368,800 last year. This included an estimated production of 323,000 tons in the Soviet Union, Poland and other Soviet-controlled territories. In Canada there was a decrease of over 27,000 tons.

These declines in the US and Canada, however, were more than offset by increases

in most other producing countries, notably Belgium and the Belgian Congo, France, Germany and Japan. Output, with 1953 figures in brackets, was:

US	775,216 tons	(865,161)
Belgium	209,729 ..	(190,372)
Canada	193,722 ..	(221,168)
Germany	166,664 ..	(148,240)
France	106,690 ..	(76,692)
Australia	104,522 ..	(90,178)

Tees-side Romance

THE growth of the Chemical & Insulating Co. of Darlington since its formation in 1926 is described as 'one of the romances of Tees-side' in the May issue of *The Tees-side Journal of Commerce*. Started in what was then a depressed area, the Chemical & Insulating Company heads a group of companies, each specialising its own particular field.

The production of chemicals in fine qualities and technical grades, apart from the chemically-based products which are used for insulation, form an important and substantial part of the company's output. Magnesium chemicals are made for industry and in high purity for pharmaceutical and medicinal purposes. Pharmaceutical chemicals made to conform to the many different pharmacopeia operating throughout the world are exported to many countries. There is a branch company in the US developed particularly for the sale of chemicals to American consumers.

One of the subsidiaries, The British Refrasil Co., near Stockton, uses a new raw material which is used in the aircraft industry particularly, for insulation and heat control. Other uses for this material, manufactured at Darlington, are being rapidly developed for use in industry generally.

Industrial Glove Demand

Such is the demand for industrial gloves that the G. Waddington & Son, Ltd., factory at Hull has been compelled to open a subsidiary factory at nearby Cottingham. The new plant has been planned for bulk production so that delivery has been stepped up and the instock system devised for patterns in most demand. The expansion has enabled the firm to produce gloves more cheaply.

Titration in Anhydrous Solvents

Part II—Practical Methods

by T. S. WEST, B.Sc., Ph.D., A.R.I.C.

DUE to the lack of a suitable range of good acid base indicators for use in anhydrous solvent titrations, considerable attention has been paid to the possibility of detecting the end-point of titrations by methods other than the use of visual indicators. Potentiometric methods were the first to receive attention. Conant and Hall (22) used a chloranil indicator electrode in conjunction with a calomel reference electrode for titrations in acetic acid solution. The indicator electrode consisted simply of a bright platinum wire dipping into the titration medium. Addition of chloranil and tetrachlorohydroquinone to the latter set up a redox system which was sufficiently sensitive to changes in acidity to be used as an acid-base indicator. A salt bridge of saturated lithium chloride solution in acetic acid made connection with the reference calomel. Most of the early potentiometric work was done in this way. For example, Clarke, Wooten and Comp-ton (33) adopted a similar method to the titration of oil acidity.

The solvent used was butyl alcohol containing lithium chloride. The electrode system utilised a calomel reference electrode making connection with the solvent through an agar-agar salt bridge and a quinhydrone electrode for the indicator. The quinhydrone-calomel system was more recently used to determine bases in formic acid (12). Neither the quinhydrone nor the chloranil indicator electrodes can be used in glacial acetic acid which has been rendered anhydrous by addition of acetic anhydride.

Indicator Electrodes

Moss, Elliot and Hall (34) used hydrogen-calomel or antimony-antimony systems for the titration of acids in ethylenediamine. The antimony reference electrode was inserted in the burette below the stop cock. These workers reported that the glass electrode did not function well in ethylenediamine. Fritz and Lisicki (35) used a glass-antimony electrode combination for the titration of acids in butylamine with sodium methoxide in benzene-methanol. The antimony-glass electrode combination

is chiefly for use in basic solvents. It cannot be used in benzene or benzene-methanol. Titrations in such a solvent may however be carried out using a pH meter with an antimony/calomel system—provided sufficient lithium chloride is added to decrease the electrical resistance of the medium. It is interesting to note here that in basic solvents the glass electrode acts as the reference electrode and the antimony as the indicator.

Several Choices

Bishop (36) reports that the glass electrode and also the platinum and antimony electrodes may be used for reference purposes in precipitation titrations in non-aqueous media. These were used in conjunction with a silver reaction electrode in halide titrations with silver nitrate. No pH stabilisation was necessary with the glass electrode when ethanol was used as the medium. The potential change at the end-point was magnified by *ca.* 200 mv and adsorption equilibrium was complete in 30-60 seconds. The presence of up to 3 per cent water was not harmful. The antimony electrode was slightly inferior in operation due to slowed equilibration at the end-point and the plating of silver on its surface (due to an exchange reaction with silver ions in solution). The platinum reference electrode attained sufficiently steady potential to permit accurate titration without the addition of a stabilising redox system, but the performance was improved by addition of quinhydrone (not only because of stabilisation, but also because of enhancement of the potential). On setting up the Pt → Ag system the potential gradually falls about 400 to 600 mv depending on the nature of the solution and a wait of 10 minutes is necessary. Generally speaking this reference electrode appears to be considerably inferior to the others.

Ruehle (37) studied the application of potentiometric methods to the titration of acids in a number of amphiprotic solvents with the calomel-quinhydrone system. Ruehle was mainly concerned with the application of Cellosolves (ethylene glycol

monoalkyl ether) particularly the methyl and ethyl derivatives. Solutions of benzoic, trichloroacetic and acetic acids (0.05N) in methyl cellosolve gave sharp end-points on titration with potassium hydroxide in the same solvent. The titrations were characterised by steady potentials and rapid attainment of equilibrium after each addition of reagent. It was also noted that the solvent power of butanol could be increased considerably by addition of acetone, anisole and 1:4 dioxan without interfering with the functioning of the electrode system.

Pure Anisole Unsatisfactory

Pure anisole is unsatisfactory as a solvent medium with the quinhydrone electrode because of apparent instability of the quinhydrone as the end-point is approached. This instability is characterised by the appearance of a blue-green colour and by potential fluctuations. The solvent power of the anisole for asphalts and pitches was not seriously impaired by addition of the butanol, yet sharp steady end-points were obtained. A similar instability of the quinhydrone in dioxan was overcome by addition of butanol and sharp end-points were obtained in the titration of salicylic and benzoic acids. Palit (20) used the calomel-glass electrode system for potentiometric titrations in his G-H solvent.

The same system was used by Seaman and Allen (30) in checking the value of potassium biphthalate as a primary standard for acid-base titrations in glacial acetic acid. The glass electrode was dipped into the titration medium and connection was made to the calomel electrode through a salt bridge containing a supersaturated solution of lithium chloride in glacial acetic acid and a saturated solution of potassium chloride in which the calomel electrode was immersed. It is also noted that others have examined the method and found the use of the non-aqueous salt bridge unnecessary, since a sleeve-type calomel electrode may be added to the solution directly. In the early stages of their work, Seaman and Allen employed magnetic stirring of the solution, but they observed that erratic potential readings were frequently introduced, and they therefore resorted to manual stirring.

Tomicek and Heyrovsky (38) used a hydrogen electrode in which the platinum foil was covered with palladium black for the titration of bases in acetic acid. This

type of electrode was found to be more resistant to glacial acetic acid—particularly acetic acid containing acetic anhydride, than the usual platinised electrode. They also noted that antimony and tellurium electrodes could also be used in addition to the usual chloranil, quinhydrone and glass electrodes. The metal electrodes had to stand immersed in the solution for 10-20 minutes to allow the establishment of equilibrium before titration began. The results of experiments on the titration of sodium acetate in glacial acetic acid with perchloric acid using the various indicator electrodes revealed that the potential changes obtained with the tellurium electrode were considerably smaller than those obtained with the antimony electrode. The antimony and quinhydrone electrodes gave similar curves, but those with the metal electrode appeared to be more sharply defined.

The potential of various metal electrodes examined by these workers was found to be more positive in acetic acid than in aqueous solution, and the less water the solvent contained, the more positive became the potential. The shift towards positive values is most marked in the case of the electronegative metals, zinc and cadmium, the potentials of which are 400 mv more positive than in water, whereas with copper and silver the shift amounts to about 100-150 mv. The hydrogen electrode was also found to be more positive in acetic acid than in water (ca. 600 mv.). This of course is in agreement with the observation of other workers that hydrogen settles on the dropping mercury electrode at more positive potentials in acetic acid than in aqueous solution.

Metal Electrodes Abandoned

After preliminary work with the metal electrodes, Tomicek and Heyrovsky abandoned the use of metal electrodes because they 'did not give correct results in relation to concentration.' Glass electrodes blown from various samples of glass behaved analogously. Moreover, since the quinhydrone and chloranil electrodes could not be used in the presence of acetic anhydride, these authors also abandoned their use in favour of the unequivocal hydrogen electrode.

Most recent work has, however, made use of the glass electrode as indicator for titrations in acetic acid. Fritz (39) reported that the use of the modern capillary type

calomel electrode frequently led to poor stabilisation of equilibrium in this solvent and preferred to use a silver metal electrode coated with silver chloride as reference electrode. This type of reference electrode is admirable in that no salt bridge is necessary. Fritz demonstrated its use by carrying out titrations of bases in acetic acid, chlorobenzene, nitrobenzene, acetonitrile, ethyl acetate and chloroform using perchloric acid in acetic acid as the titrant. Acid-base titrations in acetonitrile have also been carried out using a calomel/glass electrode system, while an antimony/calomel system has been found satisfactory for use in dimethylformamide. The latter system gives steady potentials and a surprisingly large break at the end-point (6) but in some cases the slope of the inflexion of the titration curve is much less steep than would be expected from the sharpness of the visual (indicator) end-point. This suggests that the system does not function proportionally at equivalence, or that stabilisation of potential is only achieved slowly. A platinum/calomel system has been used for titrations with lithium aluminium hydride in tetrahydrofuran.

Almost any direct reading potentiometer may be used for most of these non-aqueous potentiometric titrations. A normal battery or mains pH meter may be used quite efficiently according to Fritz (6) except in solvents having low dielectric constants where the high electrical resistance of the solution makes electrometric titration difficult. Pifer, Schmall and Wollish (40) have indicated, however, that potentiometric titrations may still be carried out in such solvents as dioxan and chloroform, etc., using an ordinary instrument with calomel and glass electrodes simply by placing these latter very close together. This has the desired effect of decreasing the resistance of the electrical circuit to such an extent that sharp and steady potentials may be obtained. The arrangement of the electrodes was achieved by passing one of these through the side wall of the titration vessel while the other was maintained in the conventional upright position.

High Frequency Titration

Relatively few papers in the literature are concerned with the application of conductometric technique to end-point detection in

non-aqueous solvents although reports on titrations with 'L' acids in thionyl chloride have appeared (41), (42).

More Promising

The application of high frequency methods appears to hold considerably more promise in this connection than the older conventional electrode-conductance technique. Wagner and Kauffman (43) have utilised HF measurements for the titration of various organic bases in glacial acetic acid with perchloric acid as titrant and have compared the method with the visual and potentiometric titration methods described by others. The titrations were carried out in a modified dielectric constant cell using an HF oscillator of the heterodyne beat type. Using a frequency of 1 megacycle, the authors found it necessary to work at low concentrations in order to gain sufficient sensitivity. Aniline and *p*-toluidine gave similar HF curves with end-points agreeing with those from potentiometric titration. The crystal violet end-points were found to be indistinct and difficult to detect. The titration of pyridine was time consuming because of slow establishment of equilibrium after the stage in the titration where a white precipitate of the perchlorate was formed. Visual titration with methyl violet as indicator was superior, although slightly lower results were obtained. An unsatisfactory end-point was found in the titration of *p*-nitroaniline although a distinct break in the curve was observed. It was concluded that *p*-nitroaniline ($K_b = 10^{-12}$) represented the lower limit of the bases that could be titrated by this method. Urea ($K_b = 1.5 \times 10^{-14}$) and *o*-nitroaniline ($K_b = 1.5 \times 10^{-16}$) could not be titrated and a potentiometric titration was equally unsuccessful.

Japanese authors (44) have described the high frequency conductometric titration of certain weak acids with sodium methoxide in a benzene-methanol system. Reilley and Schweizer (45) report that others (46) have studied the conductometric titration of eleven organic bases in glacial acetic acid using perchloric acid in the same solvent as titrant. It was concluded from these experiments that although conductometric techniques were applicable in glacial acetic acid, potentiometric titrations were to be preferred. Indeed this

conclusion seems to have been reached generally by most authors who have examined both methods.

Photometric Titration

Reilly and Schweizer (*loc. cit.*) were the first to examine the possibility of carrying out photometric titrations in non-aqueous solvents. The molar extinction coefficients of many titrants and base samples have their maximum value in the ultra-violet region. The sensitivity is therefore greatest in this region making possible titrations with more dilute reagents. Beer's law is also better followed in the U.V. region of the spectrum. Other advantages stressed by these authors are that in titrations where the reaction is slow in the vicinity of the end-point or where equilibrium is poor, the possibility of determining the end-point by extrapolation is possible. The end-point is not affected adversely by the presence of stray electric currents—this is a troublesome feature of potentiometry in solvents of low dielectric constant. The presence of inert adsorbing substances may be cancelled by increasing the intensity of the light source.

Using a Beckman quartz spectrophotometer and a titration cell similar to the original model described by Bricker and Sweetser (47), the titration of several bases and mixtures of bases in glacial acetic acid was carried out satisfactorily using the conventional perchloric acid titrant. Those such as *o*-chloroaniline and quinoline gave distinct breaks at the end-point, agreeing well with potentiometric determinations. The mixture of *o*-chloroaniline and sodium acetate could not be analysed accurately by the potentiometric method, but good results were obtained photometrically. Although the sodium acetate did not adsorb in the UV region of the spectrum, being a strong base in acetic acid, it was titrated before the *o*-chloroaniline which is a weak base. The first break on the titration curve therefore represented complete reaction of the sodium acetate. This suggests that a substance whose acid and base forms do not absorb in the UV region may nevertheless be titrated by adding a weaker base which does absorb.

Few Disadvantages

There are a few disadvantages to the UV photometric method. The fact that not all substances absorb in the region is a certain limitation of course, but the most impor-

tant factor militating against use of the method is the cost of the spectrophotometer and titration vessels. Dilution affects the absorbency readings, and they must therefore be corrected for this factor. The UV photometric method is most likely to contribute chiefly to the titration of certain substances which cannot be titrated accurately by other methods.

Reference Standards

Many of the primary standards used for the evaluation of aqueous titrants may be used for titrants dissolved in anhydrous solvents. At first sight this may appear to be surprising, but it should be borne in mind that many of the primary acid-base standards used for conventional titrants are in fact organic acids or bases or salts of these.

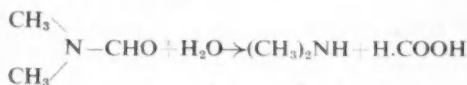
The acidimetric standard which has been favoured by many workers is diphenylguanidine. It is particularly valuable since it is very soluble in aprotic solvents such as ether and dioxan. It is readily purified, is a strong base, has a high equivalent weight and is non-hygroscopic when pure. Fritz (48) used this substance to standardise perchloric acid in dioxan. Sodium carbonate has been much used for the standardisation of acids in solvents such as acetic acid. Potassium biphthalate has also been used for the standardisation of acids in this solvent. Seaman and Allen (30) studied the evaluation of perchloric acid in glacial acetic acid using this standard both potentiometrically and with crystal violet as visual indicator. A comparison with pure sodium carbonate revealed only very slight difference between the equivalence of the two. Markunas and Riddick (49) used the same standard in an investigation published simultaneously. Alkalimetric standards have received comparatively little attention, but many authors report the use of benzoic acid (35).

There is obviously considerable scope for the development of alternative primary standard substances particularly those suited to the evaluation of basic titrants. It is probably very true to say that many substances which have been rejected as aqueous medium standards, because of insolubility, could perhaps function well in non-aqueous solvents. A study of the variation (if any) in the equivalence of a standard as medium composition changes, and of course its value

from medium to medium, is much needed.

Interferences

One of the questions which is always to the fore in carrying out titrations in anhydrous solvents is of course how much water or moisture may be tolerated. Few solvents can readily be obtained in an absolutely anhydrous condition and many solvents pick up atmospheric moisture during the process of titration when the vessels used are open to the atmosphere. The pick up of moisture is obviously most serious during protracted titrations and this is unfortunately a feature of several potentiometric procedures. Generally speaking 2-3 per cent of water can be tolerated in an acetic acid medium in which bases are being titrated, but larger amounts cause indefinite end-points due to the weak basic properties of water. Similar remarks apply to the titration of weak acids in basic solvents. Naturally the interference of water is less serious the stronger the acid or base, but there is also a variation in the maximum permissible amounts from one solvent medium to another. Carboxylic acids may be titrated in wet (5 per cent) ethylenediamine, but weaker acids require the anhydrous solvent. The titration of acids in dimethylformamide is particularly subject to interference from moisture. Fritz (6) has suggested that this is due to hydrolysis of the solvent



This is borne out by the fact that results are usually high probably due to the titration of the hydrolysis product. The presence of alcohol has a very similar effect to that of water in most titrations although it may be better tolerated in most cases.

Another atmospheric factor that must be considered in some cases is the absorption of carbon dioxide. This is only serious in the titration of weakly acid samples in solvents such as butylamine, pyridine, dimethylformamide and ethylenediamine. It can be guarded against by the usual procedures taken to guard aqueous solutions from the same source of interference.

In the titration of bases in glacial acetic acid low results are frequently encountered in the presence of heavy metal salts. This is due to the formation of feebly dissociated

acetates by reaction of the metal cations with the solvent medium (i.e. the process equivalent to hydrolysis in aqueous solution). The alkaline earths and alkali metals do not



give this effect of course. Weak organic bases interfere with the titration of stronger bases in acetic acid because they are insufficiently strong to give anything other than a diffuse end-point.

Many esters containing acid groups may be titrated smoothly and stoichiometrically in basic solvents, but others only give fading end-points and high analyses in spite of the fact that the strength of the acid is such that it should theoretically be readily titrated. The reason is thought to lie in the condensation of the solute under the catalytic influence of the basic solvent, with the formation of acidic enolisation compounds. Thus ethyl acetate may condense to form ethyl acetoacetate and ethanol. Some halogenated compounds may be dehalogenated in the basic solvents. Such reaction will of course cause high results and sliding end-points in the titration of acidity. The formation of insoluble reaction products has been discussed previously. Generally, the formation of a crystalline precipitate has a beneficial effect, but gelatinous precipitates almost invariably cause poorly defined and impermanent end-points.

Other sources of interference are inherent in certain solvents and may not be avoided except by careful control of experimental conditions. Such features concern the volatile nature of many solvents and their relatively large coefficients of expansion. The volatile nature of certain solutes in various solvents, e.g. hydrochloric acid in acetic acid need not be considered here since this effect can generally be avoided by selection of the solvent or solute. As an example of the necessity to guard against thermal expansion of the solvent, the work of Seaman and Allen (30) may be mentioned briefly. They assumed that a 0.1N solution of perchloric acid in glacial acetic acid had the same coefficient of expansion as glacial acetic acid itself, namely, 0.0011 per °C. The temperature of the titrant at the time of the titration was measured by a thermometer attached to the burette and observed volumes of titrating solution were

corrected to an arbitrarily chosen standard temperature of 29°C by a factor of 0.11 per cent per °C.

The precision of acid-base titrations in anhydrous solvents is dependent on the sharpness of the end-point as is the case with aqueous methods. The precision therefore varies according to the method of detecting the end-point and of course with the nature of the reactants. On the whole, precision is almost as high as in conventional strong acid-base titrations in aqueous solution and definitely superior to the titration of the weak acid or base in this medium if indeed such a titration is possible.

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Science in Industry

THE need for boards of directors to appreciate the significance and complexities of scientific advancement if we were to make the most of these new opportunities was referred to on 20 May by Dr. Alexander King, Chief Scientific Officer, Department of Scientific and Industrial Research, at Turnberry, Ayrshire.

Dr. King, who was speaking on 'Science and Management,' at the opening session of the fourth Scottish conference of the British Institute of Management, said that equally a proportion of scientists must be encouraged to go into management. Scientific training should also be widened in some directions to encourage those people with the right personality and intangible attributes of leader-

ship to enter the field of management, he said.

Referring to the 'tremendous reservoir' of scientific and managerial skills which we had in this country and which was changing the pattern of our industry, Dr. King said that similar changes were obvious in many other countries. Because of this changing pattern those responsible for the direction of British industry must have a new realisation of the value of making and selling to the world goods which less developed countries could not manufacture. In addition, there must be associated with this an increased rate of technological innovation and an increase in productivity.

New Pressure-Relief Valve

PRODUCTION of a glass pressure-relief valve made of highest quality borosilicate glass is announced by QVF Ltd., suppliers of the 'visible flow' glass pipeline manufactured by James A. Jobling & Co. Ltd., and the 'Quickfit' industrial plant of Quickfit & Quartz Ltd., of Stone (Staffs). Keynotes of the design of the new valve are simplicity, robustness and reliability. The valve is suitable for use under the most rigorous corrosive conditions for such operations as halogenation.

In a leaflet introducing the new valve, QVF state: 'The chemical industry having realised the unquestionable chemical stability of borosilicate glass, has been urging us for a number of years to produce a glass pressure-relief valve. QVF Ltd. introduce this simple and robustly built glass pressure-relief valve, feeling that it will be welcomed by all who have to deal with over-pressure of corrosive gases and vapours. The unit has been exhaustively tested in our research laboratories, and has undergone extensive trials in a number of chemical plants.'

The valve seat is not lubricated, no springs are used and the pressurised gas does not come into contact with metal.

New Oil Discovery in Nigeria

Oil and gas has been detected at a well recently drilled at Ekim, Calabar Province, in South-eastern Nigeria. This well, one of eleven drilled by the Shell D'Arcy Petroleum Development Company of Nigeria Ltd., since 1951, shows larger indications than previously encountered in that region and gives grounds for reasonable optimism.

Constitution of Coal

BCURA Investigations

DETERMINATIONS by osmotic pressure and diffusion coefficients of the molecular weight of coal indicate values in the range 600-3,000. But two other methods—light scattering and ultra-filtration—show that colloidal particles of quite large size are also present. Some hint of an explanation of this anomaly is provided by indications of interaction between, and aggregation of, molecules in the coal solutions. It seems that particle sizes of the aggregates change with concentration.

An account of this and other work on the constitution of coal is contained in the annual report for 1954 of the British Coal Utilisation Research Association. Considerable progress has also been made in fractionating coal solutions. The use of the fluorescence spectrum has enabled the differences between fractions to be shown more clearly than with the ultra-violet or infra-red spectrum.

Six Fractions Studied

Six fractions, totalling nearly 60 per cent of the original coal, were obtained by successive extraction and comparison of the infra-red spectra of these and the undissolved residue supported the conclusion reached earlier that all these fractions contained essentially similar structures. This conclusion has been supported by X-ray investigation. It appears that the fractions differ in the mode of molecular packing.

Importance is now being attached to the study of the chemical reactions of coal, work which is necessary to bridge the gap between the physicochemical and the organic chemical work needed to complete the investigation of the constitution of coal. Among results which have been obtained may be mentioned; the virtual absence of ethylenic double bonds, the absence of ketonic carbonyl groups in extracts from bright coals, the appearance on hydrogenation of infra-red bands corresponding to ether linkages, suggesting that aromatic ethers and heterocyclic oxygen are features of coal structure.

Polarographic work has given no indication of the presence of quinones in coal. However, the waves given by a quinone of high molecular weight—caledon jade green—were less pronounced, so that it is possible that in more complex substances the presence of quinone groups may be obscured.

OEEC Completes US Tour

TITANIUM, the 'wonder metal', which developed in about five years from a laboratory curiosity to a very useful metal in aircraft and chemical industries, was among the new elements of growing industrial importance whose production and fabrication were studied by an OEEC team which has just returned from the US. Other important non-ferrous metals studied were zirconium and beryllium.

This Technical Assistance Mission carried out its tour at the invitation of the US Foreign Operations Administration. It comprised sixteen experts from eight OEEC countries:—Austria, Belgium, France, Germany, the Netherlands, Sweden, Switzerland and the UK. Among its members were Mr. S. Morgan (UK), the chairman, Mr. G. Bjorling (Sweden), secretary, and Professor G. D. Fast (Netherlands), who was concerned with the early stages of high-grade zirconium production.

Although the Mission was aware that in such new and highly competitive fields it would not be possible to study the latest industrial developments, its members were enabled to meet many industrialists and research workers, and were permitted to examine in detail the pilot plants of the US Bureau of Mines. In return, they gave their hosts information about European research and experience in this field.

The Mission is to prepare a report on the results of its tour, which will be published later by OEEC.

Industrial Health

Addressing the General Federation of Trades Unions recently at Scarborough Public Library, Sir George Barnett, chief inspector of factories, said he was expecting a directive from the Industrial Health Advisory Committee to carry out a field investigation survey on the general aspect of industrial health. 'Doctors can tell us where the danger lies, but the cure has to come from the engineer, chemist and physicist,' he said.

Price's Cut Prices

Price's (Bromborough) Ltd. announce that as from last Wednesday the prices of their stearines were reduced by £5 a ton.

New Synthetic Rubber

Du Pont Product has Many Uses

A NEW synthetic rubber which is completely resistant to ozone cracking and dispenses with the need for carbon black reinforcement has been perfected by the American Du Pont organisation. It is called 'Hypalon' and is distributed in this country by Durham Raw Materials Ltd.

'Hypalon' is of particular value as a protective coating for a wide range of rubber goods and fabrics. It shows good adhesion qualities with rubber, fabrics, paper, wood, concrete and metal and is flexible at low temperatures, being effective at -54°C without the aid of plasticisers. Resistance to sunlight, scuffing and abrasion is exceptional and it can be compounded in lacquer form in a wide variety of colours without difficulty. In addition, 'Hypalon' resists the deleterious effects of chemical action, particularly the oxidising inorganic acid group, and is heat-resistant up to 120°C .

The Du Pont laboratories have carried out extensive flex-tests with Hypalon-

treated rubber. It was found that the 'Hypalon' coating stretched 100 per cent and after 300,000 flexes in a flex-tester showed no signs of film failure or loss of adhesion. It is significant that, in all cases, the rubber stock underneath had cracked and broken.

Other tests included the application of 'Hypalon' lacquers to black and white-sidewall tyres, car floor mats, accelerator and brake-pedals. In the tyre tests, several thousand miles of service proved that 'Hypalon's' resistance to scuffing and abrasion is good, its adhesion qualities adequate and, even in the case of brake-pedals where hard-wearing demands are excessive, the lacquers showed exceptional resistance. Weather tests were also successful.

'Hypalon' may be compounded on a mill or in a Banbury mixer in the normal manner and can be dissolved by suitable solvents. It can be applied as a thin protective coating to other rubbers by brush or spray.

The ultimate cost of the Hypalon-treated finished product is not markedly more expensive than the cost of similar goods now on the market.

Shell Fights Ceylon Weed

THE Government of Ceylon are considering spending £75,000 per year in the next five years on a weedkiller for the eradication of salvinia, a rapidly spreading water weed which is threatening agriculture, and also public health by causing stagnation of water and forming breeding grounds for insects.

Salvinia was brought to Ceylon for botanical studies in 1939, and the small portions discarded after study survived and formed new plants in the waterways. In 13 years the weed has spread over 25,000 acres; choking paddy fields, irrigation canals, streams, and reservoirs.

A free-floating fern with no true roots, mature salvinia is a mass of hairy leaves on fragile stems, and its removal by hand is impracticable owing to the enormous labour that would be required to extricate every part of the plant. In other parts of the world where it grows it is kept in control by plants which do not exist in Ceylon.

Salvinia is resistant to most herbicides, but after months of research with the co-operation of the Ceylon Ministry of Agri-

culture, Shell have evolved a product, formulated with petroleum, which has been successful in clearing large areas. Shipments of salvinia weedkiller manufactured at Shell Haven, Essex, are now being used in Ceylon. It consists of pentachlorophenol plus wetting agents in an oil emulsion.

Calofort 'S' Production

JOHN & E. Sturge Ltd., Birmingham, announce that the first stage of their plant for the manufacture of Calofort 'S,' completed last year, is now working at full capacity. Calofort 'S,' a surface-coated 'activated' calcium carbonate, is intended primarily for the rubber industry as a white reinforcing filler.

It can also be used in the manufacture of printing inks, paint and in the processing of vinyl plastics, as a high quality filler with an ultimate particle size well below 0.1 microns.

The Witco Chemical Co. Ltd., Bush House, Aldwych, London, W.C.2, are the agents for the sale of Calofort 'S' to the rubber trade in the UK.

The 1955 National Industrial Safety Conference

NEARLY 700 delegates attended the National Industrial Safety Conference organised by the Royal Society for the Prevention of Accidents at Scarborough from 20-22 May, under the chairmanship of Sir George Barnett, the Chief Inspector of Factories. A new and successful feature of the conference programme was a debate on the motion: 'That this conference agrees that a safety committee forms an essential part of an accident prevention organisation'.

Not only did the conference attract a record number of delegates, but also a record number of exhibitors in the exhibition of safety equipment and appliances. The exhibition stands, which were occupied by firms manufacturing such items as machine guards, fire appliances, safety footwear, goggles, protective hats, protective clothing, barrier creams, etc., were thronged with delegates whenever the exhibition was open.

Sir George Barnett said that one of the greatest obstacles in the way of progress in accident prevention lay in the ignorance of the fundamental principles of prevention, with its consequential indifference to the need for it, and complacency on the part of a great number of employers and senior supervisors in industry. Unfortunately, these people regarded the occasional accident as a natural adjunct to—almost an essential and inevitable part of—factory life. These people required persuading to appreciate fully their responsibilities to establish safety organisations within their own works.

Need Not Recognised

In the UK there were about 250,000 establishments registered as either factories or workshops and, of these, 22,000 were sufficiently sizable to employ not less than 50 people. Yet, even so, only about 4,000 of them were known to have an appreciable safety organisation or to have thought it worthwhile to become members of the Royal Society for the Prevention of Accidents.

Sir George urged all delegates to the Conference to do their utmost to make known the value of accident prevention in

these factories where it was at present not practised. He said that long experience of a competitive industrial world had not shaken his fundamental belief that no employer or supervisor would knowingly and deliberately expose one of his fellow-men to certain danger for the mean motive of his own gain. He was sure that employers and workers would actively co-operate in the work of accident prevention as soon as the need for it, and the advantages to be gained from it, were brought home to them.

Voluntary Efforts Best

Though, said Sir George, a reasonable amount of legal enforcement of minimum standards was an essential part of accident prevention, he was nevertheless of the opinion that more accidents would be prevented by the voluntary efforts of those who earned their living in industry than by the passing of laws, the making of regulations, or increased State inspection.

Mr. H. L. Ginaven, a director of Good-year Tyre & Rubber Co. (Great Britain) Ltd., but a native of the US, summarised his views, as a manager, of industrial safety as: 'Safety of the people, by the people, and for the people.' This, he said, should be the objective of enlightened management.

Mr. Ginaven said that a good manager has to run his business as successfully as possible. To get value for money he must achieve efficiency, productivity and the avoidance of waste. Safety, he said, fits into this picture completely, and he drew attention to the waste of manpower and time that can result from industrial accidents. In the rubber industry alone in 1954 a total of 786 working days were lost as the result of many thousands of minor accidents which each took a man from his work for about a quarter of an hour while he visited the first aid room.

He put forward a number of points which he regarded as the responsibility of management. The first of these was for all directors, managers, supervisors and foremen to be sold on the idea of safety.

Industrial Safety

Secondly, the organisation should join some such body as RoSPA because he believed a central organisation to be as essential for safety as for any other countrywide or worldwide movement. Management should employ a good safety officer who had a real conviction that he wanted to prevent accidents; in a small concern this officer might combine his safety duties with another appointment. A safety committee which was truly representative of the management and of the workers should be elected. He also regarded it as important to keep good records of all accidents because it was only by studying these and by eliminating all the minor accidents that eventually the more serious lost-time accidents could also be eliminated. He recommended the services of a medical officer, for, he said, it was better to prevent industrial disease rather than to cure it later. Mr. Ginaven said that managers should stimulate interest in safety by organising accident prevention campaigns. He supported safety competitions, for he believed that competition in any field lead to a higher all-round standard.

Safety Incentives

Mr. John Gardner, M.A., Central Safety Department, Imperial Chemical Industries Ltd., spoke on 'Safety Incentives'. Most accidents occur through some form of human failure, he said, and this could best be overcome by developing within the individual a desire to avoid behaviour likely to cause accidents. In turn, this attitude would flourish only if it was the attitude of the working group; that was if the community frowned upon such behaviour as abnormal. In his view, the best way of encouraging such a group attitude in industry was through management example.

The first and prime essential was that management should be sincere in its desire to run the plant without accidents, and every manager, while knowing his legal obligations, should, over and above this, feel a personal responsibility for those under him.

In the smaller works the manager by direct personal influence over his workers and by clearly demonstrating his enthusiasm for safe working could give to his workers the incentive to follow his example. The manager could also see that his immediate

subordinates fully shared his own enthusiasm.

In larger concerns, where the control was more remote, the manager had two means of mobilising support of those under him. He should make full use of the existing means of joint consultation and where this was not in existence special accident prevention committees should be established. Mr. Gardner emphasised that the personal way—by word of mouth—was the best way for safety ideas and instructions to be passed down the line of communications.

Monetary Awards

Mr. Gardner mentioned monetary awards as incentives for safe working, but felt that if safety was regarded as an essential part of the job then a man should not be paid extra for it. Other incentives touched upon were the awards of flags, cups, or personal gifts to those employed in the departments or works producing the best accident reduction figures. He also drew the attention of the conference to the incentives for safer working which were induced by clean, tidy and well-lighted surroundings.

Mr. Gardner said that he did not hold the view that production incentive schemes militated against safe working, adding that in his experience properly applied schemes had no such effect.

In closing, the lecturer said that the greatest incentive to safety for the worker was the sure and certain knowledge that the management believed in the right of men to earn their bread without imperilling their lives and limbs.

The motion for the debate was proposed by Mr. H. G. Frampton, Deputy Chief Safety Officer of the Central Electricity Authority. Mr. Frampton claimed that when an accident had occurred it was quite essential for certain interested parties—the man's foreman, the factory manager, and the insurance company, and possibly the injured man himself—to discuss the accident. On the other hand, when people come to study processes and operations, to arrange building and plant, these matters could not properly be settled without accident prevention being considered. These matters, he said, have to be settled by consultation between the people responsible. He claimed that industry could not function without these consultations and that they therefore formed an essential part of the organisation in which they operated.

Fire Research 1954

Important Information in Annual Report

OBSERVATION has shown that fires are rare in the petroleum and similar industries where large quantities of inflammable solvents are handled. The dangers are recognised, plant is designed and operated with safety in view, and adequate fire-fighting facilities are readily available. It would appear that fires are caused, not by the intrinsic dangers of a process itself, but quite simply by the failure to take the correct safety precautions. In many cases the dangers may not be realised, or it may not be known that suitable protective equipment can be obtained.

'Fire Research 1954' published by the Stationery Office for DSIR and the Fire Office's Committee, price 3s., contains information on the causes and effects of a wide variety of types of fire, information which should be known to all who are in a position of responsibility, and on whom the safety of others may depend. The Fire Research Board, which is responsible for directing research on the problem of fire prevention and control, says that the current programme has had to be well pruned to remove items on which the results already obtained warranted a reduction in priority. The Fire Research Station is awaiting the erection of permanent buildings that will enable some of the work to be carried out on a more adequate scale. As the station develops it is hoped that it will be possible to devote a larger proportion of effort to basic work. At present the pressure for solutions to current problems is very heavy.

Non-inflammable Textiles

A concerted attempt is being made by Government departments, the textile industry and research associations to see what steps can be taken to reduce the hazard of clothing fires. Pure nylon fabrics will not propagate flame as the material melts too rapidly ahead of the flame. If, however, the fabric has been stiffened with formaldehyde resins it will burn almost as rapidly as cotton. Similarly if the nylon has been dyed with inorganic dyes, the inorganic oxides produced on heating will form a matrix on which the nylon can burn.

One of the greatest hazards in industry

is the spontaneous heating and ignition of materials stored in bulk. A survey of information available on outbreaks of fire in cotton bales has shown that these fires are not normally due to spontaneous combustion within the bale, but to external causes such as the friction and impact of steel bands. Once ignited these bales may smoulder for weeks without being detected. Fishmeal on the other hand, will ignite spontaneously but the risk may be reduced very greatly by correct drying and stacking.

Smouldering of dust in thin layers presents a similar problem to that of spontaneous combustion. Estimates show that a carelessly discarded cigarette may start a train of smouldering which will result in a fire many months, or even two or three years, later.

Fire Suppression Agents

A knowledge of the best suppression agent to use is of prime importance when attempting to extinguish a fire. It was reported in the previous report that fine sprays were more efficient normally for the extinction of the more volatile liquids, whereas coarser sprays were more efficient with fires in liquids of higher boiling point. Extension of this work has shown that the ease with which a fire is extinguished may depend to an important extent on the time for which the fire has been burning. When petrol and benzole fires were attacked with fine sprays within six to eight seconds of ignition, a thin blue flame was established close to the edge of the containing vessel which could not as a rule be extinguished within 60 seconds of spray application. With a longer pre-burn the fire was extinguished in a few seconds. These results indicate that not even fine sprays are always reliable in extinguishing fires in volatile liquids.

A re-examination of the use of wetting agents ('wet-water') in fire-fighting has been continued during the year. It has been concluded that 'wet-water' is likely to be more effective than plain water for the extinction of fires in closely-packed fibrous materials, but it seems that for practical purposes its use should be confined to certain special types of fire.

In conclusion some special fire hazards

Industrial Safety

may be mentioned. Work on the danger of sparks from aluminium paints has shown that a mixture containing 18 per cent coal gas and 82 per cent air was the most readily ignited by this source. Fires caused by dust explosions are also described and much work on this topic has been done by the Safety in Mines Research Establishment and the Factory Department of the Ministry of Labour. In the course of experiments on the removal of static from petrol it has been found that the addition of triethylamine oleate effectively prevents the accumulation of static charges over long periods.

Cominco Safety Month

EVERY night in May a rocket burst over Trail, BC. If it sent out a shower of green stars it meant that no Consolidated Mining & Smelting Co. (Cominco) employee had had an on-the-job accident during the day. If, however, the stars were red it meant that a lost time accident had been recorded. A lost time accident is one which causes an employee to lose one or more days from work.

May was safety month at Cominco, and this pyrotechnical display was one of the several features designed to focus attention on safety. Others included safety quizzes and safety limerick competitions. Prizes to the value of hundreds of dollars were given away during the month, and films, speakers, radio, first aid competitions and extra safety meetings were used to drive home the message: 'Safety is your business.'

The value of these safety campaigns is indicated by the fact that, with the exception of 1952 when the accident rate remained steady, Cominco employees have set a new safety record each year since 1943.

New Fire Committee

THE Fire Research Board of DSIR and the Fire Offices' Committee has recently set up a Committee on Industrial Fires and Explosions with Professor A. A. Ubbelohde, F.R.S., as chairman. The terms of reference of the Committee are as follows:

(1) to study industrial hazards which

arise from the flammability of certain dusts, vapours and gases; and

(2) to advise on a research programme to provide information that will enable industry and other bodies to avoid, or reduce the effects of these hazards.

The Committee consists of members drawn from industry and the universities with representatives from the Factory Department, the Safety in Mines Research Establishment and the Joint Fire Research Organisation. The secretary of the Committee is Dr. D. J. Rasbash, Fire Research Station, Boreham Wood, Herts.

The first meeting of the Committee was held on 29 April. It was decided to consider at subsequent meetings a number of reviews of problems contained within the terms of reference in order to determine how the available information would be most usefully applied and what are the main gaps in this information.

Dunlop Safety Aprons

AT THE Exhibition staged by the Royal Society for the Prevention of Accidents, at Scarborough, Dunlop showed a range of industrial protective aprons, such as the black acid-resisting, the off-white neoprene for dairy work and kindred trades, and the brown p.v.c. for tanners, chromium platers and engineering trades; a sandblast operative's helmet completely covered in rubber, light to wear yet strong and highly resistant to damage; seamless latex gloves and gauntlets and a representative selection of Fortiflex containers.

Defendants Awarded Judgement

At Leeds Assizes on 7 May, Mr. Justice Lynskey gave judgement for the defendants, Lee-Midgley, Whitehead & Co., Spartan Works, Carlisle Street, Sheffield, in an action brought by Yorkshire Metal Sprayers, Argyll Works, Clarence Road, Leeds, arising from an explosion at the plaintiff's works in Dolly Lane, Leeds. At the time an employee was operating a metal spraying gun and using a cylinder of propane gas supplied by the defendants. Awarding the claim of £574 8s. 2d., the Judge said that some ignorant, unauthorised or malicious person had loosened a nut at the top of the cylinder which had been to five other customers before it reached the plaintiff.



CHEMICAL PROCESS PRINCIPLES. Part I, Material and Energy Balances. By O. A. Hougen, K. M. Watson & R. A. Ragatz. John Wiley & Sons, New York; Chapman & Hall Ltd., London. 2nd Edition. Pp. xxxv + 504. 68s.

The second edition of this well-known text book is particularly welcome since the 1943 edition has been unobtainable for some time, except in the combined volume including parts II and III. The publication of Part I as a separate text will permit its use by first and second year students without imposing the necessity of buying parts II and III before they are required.

The new edition contains two new chapters—an introductory chapter dealing with mathematical procedures and a chapter on adsorption. In addition the text has been expanded in the sections dealing with crystallisation and solubility relationships. Brief reference to nuclear reactions has also been included. Much of the text has been rewritten and a large number of new problems have been included both in the text and in the problems set in each chapter.

For those who are familiar with the earlier text it need only be added that the additions and modifications serve to improve its value as a text book. For anyone who is unfamiliar with the previous text it should be said that this particular book deals with principles of chemical process design and is essentially a study of physical and chemical principles involved in calculations concerning chemical plant. For this reason it includes applications of thermodynamics, thermophysics, thermochemistry and develops generalised procedures for estimating vapour pressures, critical constants and heats of vaporisation of common organic compounds. The final chapters develop methods for the calculation of the material balances and energy balances of selected chemical processes. In each chapter the principles involved are illustrated by typical

calculations taken in most cases from actual processes, and a further series of problems are appended to each chapter. These problems, also selected from actual industrial processes, are carefully graded to enable the student to acquire confidence in the solution of such problems.

The book is particularly recommended to students following a degree course in chemical engineering or studying for the examinations of the Institution of Chemical Engineers, but it will also be of considerable value to chemical engineers in industry and to chemists who wish to understand the chemical engineering procedures as applied to their particular problems.—F. MORTON.

CHEMICAL CALCULATIONS. By H. V. Anderson. 6th edition. McGraw-Hill Publishing Company, Ltd., New York and London. 1955. Pp. viii + 305. 34s.

Anyone who has had to learn the fundamentals of physical and analytical chemistry will appreciate that a new understanding and meaning comes to the subject when the theory has been applied successfully to a numerical problem. The value of the worked problem as an aid to understanding has, rightly, been recognised and it now occupies an important place in student chemical instruction. The demand, therefore, for books containing chemical problems is great and has grown so that the appearance of a new book of chemical calculations is of considerable interest. Generally, however, these types of book have several inherent weaknesses; either they omit subjects on which problems are sought or the examples provided are limited.

The book under review, the 6th edition of a very well-known publication, is remarkably free from these weaknesses and has many commendable features. The author starts right at the beginning with a chapter on measure and weights and proceeds through the usual elementary work on

density, measurement of temperature, gas volume relations, chemical formulae, volumetric work and so forth, to simple electrochemical problems, oxidation-reduction, the law of mass action, thermochemistry and solubility product. Welcome changes in this edition are the re-arrangement and the re-writing of the subject matter on significant figures and exponents; gram-atom and gram-mole relations; fundamental gas laws; percentage concentration; and the chapter on the language of chemistry.

Commendable features in this book are the number of worked examples which become progressively more difficult, and which are explained in a clear step-by-step manner; the large number of varied problems for solution; the explanatory sections at the beginning of each chapter making each an independent unit; and the outline of material to be covered at the beginning of every chapter. Seven tables of constants and data are also provided in the Appendix.

This book will satisfy admirably the requirements of the Intermediate B.Sc. student and those using the book for the first time will appreciate the very lucid way in which the ion-electron method of balancing oxidation-reduction equations is presented. It will also be of value to the more-advanced student.

Perhaps one suggestion which might be made to the author, in the interest of making the book more complete for the intermediate student, without too big an increase in size, would be the inclusion of a section dealing with osmotic pressure.

The book is clearly written and well-produced and will receive general acclamation, not least being the instructor who will find in it a particularly useful reference book to supplement his stock of chemical problems.

—R. J. MAGEE.

ORGANIC CHEMISTRY. By L. F. Hatch. McGraw-Hill Book Co., New York & London. 1955. Pp. 324. 34s.

This handsomely-produced, well illustrated volume of 300 pages is primarily an account of the applications of organic chemistry in our modern civilisation. It contains some useful information on modern industrial methods in the US. The author ranges over a wide field. Among other topics, he writes about petroleum, fats,

waxes and detergents, soap, dyes, explosives, drugs, fibres, insecticides and antibiotics, and all in a thoroughly up-to-date manner. There are numerous useful tabular summaries; one of the more unusual lists the 26 volatile compounds detected in apple juice.

Some chapters are extraordinarily interesting and contain information not commonly available, e.g. those on soaps and detergents, and on proteins (with a useful analysis of the hydrolysis products of β lactoglobulin). Medicinals are arbitrarily subdivided into anaesthetics, antibiotics, analgesics, antipyretics and antiseptics and among the recent compounds mentioned are benzedrine, hexylresorcinol, benedryl and sucaryl, chloromycetin and dihydrostreptomycin. A very full chapter on 'Organic Chemistry and Agriculture' discusses modern insecticides such as methoxychlor, lindane and dieldrin; weed-killers such as 2:4 dichlorophenoxyacetic acid, and the pre-emergence herbicide IPC (isopropyl-N-phenyl-carbamate) which has proved so effective with peas.

On the whole the style is clear and concise, though such terms as hydrohalogenation, chlorhydrination and hydrogenolysis will be unfamiliar to many British readers. It is unusual, too, to find the benzene ring printed with the double bonds shown inside it, and it is more difficult to grasp the structural formulae of long chain compounds when there are no stops between the adjacent atoms.

Fundamental chemical principles are kept to a (sometimes inadequate) minimum. Occasionally the formula of an important compound is given without its name, sometimes its name is given without its formula. Beyond a reminder that it is the NO_2 ion which is the effective agent in nitration processes, there is no mention of the mechanism of organic reactions.

There are two rather surprising omissions: there is no mention either of the blue starch-iodine complex or of the use of 2:4-dinitrophenylhydrazine instead of phenylhydrazine in the identification of aldehyde and ketones.

The book cannot be regarded as a formal text book of organic chemistry, but as an interesting, informative account of its applications it will be enjoyed by a wide variety of readers.—K. STUART.

HOME

The Chemical Society's Library

The library of The Chemical Society will be closed from 4 July until 15 August to permit re-furnishing and a general reorganisation. The photocopy service will be suspended from 10 June. The librarian requests that all books and periodicals on loan be returned not later than 27 June.

Reichhold to Make Phthalic Anhydride

In his recent statement issued with the company's accounts, Mr. Walter H. Breuer, chairman of Reichhold Chemicals Ltd., says that it has been decided to build a plant for making phthalic anhydride on the site of the Beck, Koller works at Liverpool (see THE CHEMICAL AGE, 1955, 72, 1214). Orders for equipment have already been placed, and the American associate company are sending technicians and personnel. It is planned to start production early next year.

More Work in Chemical Trades

The May issue of the *Ministry of Labour Gazette* reports that at the end of March this year 511,500 were employed in the chemical industry in this country compared with 497,000 for the corresponding period last year. By far the biggest proportion of these (215,800) were engaged in chemicals and dyes. Other estimates: pharmaceuticals (62,000), explosives (52,800), soaps, candles, polishes, ink, etc. (49,700), paint and varnish (40,000), mineral oil refining (38,900), other oils, greases, glue, etc. (32,500), coke ovens and by-products (18,500).

Seeks Evidence of Cadmium Poisoning

The Industrial Diseases Sub-Committee of the Industrial Injuries Advisory Council is considering whether cadmium poisoning should be a 'prescribed disease' under the National Insurance (Industrial Injuries) Acts, and, if so, for which occupations. At present industrial injury benefit can be claimed for acute cadmium poisoning as 'injury by accident'. The purpose of the enquiry is to investigate the possibility that prolonged exposure to cadmium can give rise to chronic ill-health against which insurance cover should be provided. Those interested are invited to submit written evidence to: The Secretary, Industrial Injuries Advisory Council, 10 John Adam Street, London W.C.2.

Every Banana in Polythene Wrap

The Metal Box Company has received a contract to supply 10 tons of polythene film a week to the Banana Board of Jamaica. The Diothene (the company's trade name for its polythene film) will be used to wrap the entire banana output of the Colony. Jamaica exports about 12,000,000 stems of bananas to the UK in a year.

Hess Products' Swiss Agency

Hess Products Ltd., of 4 Albion Street, Leeds, have appointed as their Swiss selling agents, Chemische Fabrik Schweizerhall AG, Elsasserstrasse 229, Basle.

To Visit Sweden

Derek J. Tow, head of Projects Initiation Department of Head Wrightson Processes Limited, and recently-elected chairman of the graduates' section of the Institution of Chemical Engineers, is to lead a group of some 14 chemical engineers to Sweden from 16 to 26 June. They will visit a number of industrial concerns.

ECGD Changes Leeds Office

On Thursday the Export Credits Guarantee Department in Leeds moved to new offices at Weetwood Chambers, 93a Albion Street, Leeds 1. The office, which covers North and East Yorkshire (but excludes Middlesbrough, Redcar and Thornaby-on-Tees), is a Government department providing exporters with insurance against trading risks. It is now handling policies with a face value of £11,750,000 compared with some £7,000,000 eight months ago.

Fuel Course for Engineers

Works and plant engineers who would like to take a refresher course in current practice in fuel efficiency can do so for five days in September at the Clarendon Laboratory, Oxford. Starting on the 25th, the course, organised by the National Industrial Fuel Efficiency Service and the Southern Regional Council for Further Education, will comprise 15 lectures by eminent fuel technologists and a visit to a works. The fee for the course, inclusive of meals and accommodation at Brasenose College, is £9 9s. Copies of preliminary programme and registration forms can be had from: Mr. E. S. Watkin, Ailsa House, 181 Kings Road, Reading, Berkshire.

• OVERSEAS •

Anti-Coagulant Synthesised

A new anti-coagulant has just been synthesised at the Canadian National Research Council's Maritime Regional Laboratory at Halifax, NS, the National Research Council announced recently. Basic material for the new anti-coagulant is cheap and abundant, as it comes from kelp, a type of seaweed. The synthetic compound has been shown to be non-poisonous in large doses, and to act for the required length of time.

ACC & CE Inc. Announces New By-Laws

The Association of Consulting Chemists & Chemical Engineers Inc. adopted on 26 April amendments to its by-laws to permit more flexible qualifications for candidates. Specifically, new provisions are included in a re-classification for foreign and affiliate members, the first term applying to members with headquarters overseas, not including US territories, and the second applying to consultants having recently entered consulting practice.

OEEC To Hold July Conference

The first European Conference on Statistical Quality Control will be held in Paris on 11, 12 and 13 July. Attending the conference, sponsored by the European Productivity Agency of the Organisation for European Economic Co-operation, will be statistical quality control experts from Belgium, France, Germany, Italy, the Netherlands, Sweden, the UK and the US. Lectures will be given on such subjects as the use of statistical quality control in management, training and experimentation, and its technical applications in industry, and texts will be sent to the participants prior to the conference.

Bureau of Mines' Antimony Report

Last year the world production of antimony was estimated at 35,000 short tons, representing an increase of 9 per cent above the 32,000 tons produced in the previous year, reports the Bureau of Mines, US Department of the Interior. In 1954 the US imported 8,800 tons of antimony, 23 per cent less than was imported in 1953. Domestic smelter production was 8,500 short tons, 1,400 tons more than was produced in 1953.

Fire Detection System

The Pyrene Manufacturing Co., of Newark, New Jersey, US, has announced a new fire detection system which can warn against a smokeless, smouldering fire much more quickly than present methods. The basis of the system is a round detector head containing radium which sets up an electric current in the air between two electrodes. When invisible combustion products enter the detector, the current drops.

Greeks Use More Fertiliser

Before the war Greece used 22,716 tons of fertilisers a year, broken down as follows: nitrogenous 5,916 tons, phosphates 13,872 tons, potash 2,928 tons. This year the total will be 117,500 tons, broken down as: nitrogenous 60,000 tons, phosphates 50,000 tons, potash 7,500 tons. Except for fuels, fertilisers are Greece's largest single import, amounting last year to \$16,155,000.

Standard Oil Restricts Imports

In a recent statement at Linden, New Jersey, Mr. J. M. Rathbone, president of the Standard Oil Company, said that the company had set a definite ceiling on the amount of foreign oil it would import this year. The action was in line with the Senate approval of a Bill extending the Reciprocal Trade Agreements Act. Product imports, which are almost entirely heavy industrial fuel oil, since 1 April are being restricted to the same amount as was imported in the last nine months of 1954, plus 4½ per cent.

Joint Titanium Research

The US Bureau of Mines has entered into an agreement with the Wah Chang Corporation to conduct research and development work on an improved process for the production of titanium sponge metal. The work will be done at the Bureau's experimental station at Boulder City, Nev., where part of the titanium pilot plant will be reactivated for the duration of the project. The objective is to conduct pilot plant tests and improve a process for making high-quality titanium sponge metal that the corporation has developed on a small scale in its laboratories at Glen Cove, NY. Wah Chang Corp. will bear most of the expense.

PERSONAL

Mr. C. S. J. SUMMERLIN, managing director of Plysu Products Ltd. and Plysu (Housewares) Ltd. (Woburn Sands, Bletchley, Bucks), arrived home on Whit Sunday after a two-week visit exploring markets in the US and Canada.

Mr. R. A. COOKSON, of Associated Lead Manufacturers Ltd., Newcastle-on-Tyne, and a former director of colliery companies in the North, has been elected president of the Newcastle-on-Tyne and Gateshead Chamber of Commerce.

Blaw Knox Ltd. announce that Mr. JOHN CHAPLIN, A.M.I.Mech.E., has joined the executive staff of the company's Chemical Plants Department. This department was inaugurated in 1954 to manufacture in Britain the Buflovak range of equipment which was previously available only from the US. Mr. Chaplin's appointment will extend the activities of the department.

As a further step in its programme of building an advisory and technical service organisation for separational problems in industry, Sharples Centrifuges Ltd. announces the following appointments: Mr. R. T. COLLINS to senior project engineer (Midlands), and to be responsible for commissioning Sharples vegetable oil refining plants in all parts of the world. Mr. G. H. DUFFIELD, Dip.Mech.E., Dip.Chem.E., A.M.I.Mech.E., to senior project engineer (Northern), and to be responsible for all technical work and applications engineering in the North of England. Mr. M. W. VINCENT, B.Sc., A.R.I.C., to be concerned with all aspects of project development work in the Tower House laboratories at Stroud, Gloucester.

The following officers and executive committee members will serve the Industrial Pest Control Association for the year 1955-56: *president*, Mr. K. F. GOODWIN-BAILEY (Cooper McDougall & Robertson Ltd.); *vice-president*, Mr. A. FRASER MCINTOSH (Thomas Harley Ltd.); *hon. treasurer*, Mr. S. W. HEDGCOCK (Disinfestation Ltd.); *hon. auditors*, Mr. S. BREMER (The Ideal Insecticide Co.), and Mr. E. L. WILLIAMS (Shell Chemicals Ltd.); *executive committee*, Mr.

G. A. CAMPBELL (The Geigy Co. Ltd.), Mr. R. A. H. FREEMANTLE (Esso Petroleum Co. Ltd.), Mr. C. A. E. STUART KREGOR (W. Edmonds & Co. Ltd.), Mr. S. F. SPRANGE (The London Fumigation Co. Ltd.), Mr. G. L. WINDRED (Imperial Chemical Industries Ltd.), Mr. DUNCAN R. LEITCH, *ex officio* (Ratsouris Ltd.).

Mr. GEOFFREY LOASBY, B.Sc., F.R.I.C., F.T.I., of Bryn Collen, Llanover, Nr. Abergavenny, Mon., director of British Nylon Spinners Ltd., Pontypool, was elected chairman of the Textile Institute's Council at the Council's May meeting, to succeed Mr. J. A. NASMITH who is now living in the US.

Mr. E. L. HARRISON, managing director of Quickfit & Quartz Ltd., will tour the US and Canada to assess market requirements. He goes first to Rochester, New York, and then to Halifax, Nova Scotia, Montreal and Toronto. In Toronto Mr. Harrison will visit the Toronto Trade Fair. He will return later this month.

Samuel Fox & Co. Ltd. announce that Mr. G. R. BOLSOVER, director and consulting metallurgist, will retire on 30 June. Mr. R. D. POLLARD has been appointed to succeed him on the board and as chief metallurgist as from 1 July. Mr. O. INMAN retires from his position as director of developments on 30 June, but his services will be retained as engineering consultant to the company and he will remain a member of the board of directors.

Birlec Ltd., which recently joined A.E.I. Ltd., announce the appointment of Mr. K. L. MOON as sales manager of their induction heating division. Mr. A. E. PICKLES continues as manager, and Mr. R. ABBOT as technical manager. Another Birlec appointment is Mr. H. J. PODMORE to be sales manager of the specialist Dryer Division. Mr. T. C. SANDERS remaining as manager, and Mr. J. W. CARTER as technical manager of the Division.

Mr. A. GODSELL, Mr. J. H. ORR and Mr. G. S. POUND have been appointed directors of Coalite and Chemical Products.

Publications & Announcements

'PYREX' brand chemical resistant glass is well known for its chemical durability and its resistance to thermal and mechanical shock. The latest catalogue produced by the makers, James A. Jobling & Co. Ltd., Sunderland, contains facts and figures illustrating these points. For example hydrochloric acid gave, after boiling for six hours, a loss of 1.85 mgm. per sq. dm. It is recommended that no piece of Pyrex apparatus should be heated above 450° C for long periods. Any apparatus which is heated to this temperature should be allowed to cool slowly, and if there is a possibility that permanent stress has been set up the apparatus should be re-annealed at a temperature of 560° C and allowed to cool very slowly. An interesting new addition to previous catalogues is the section dealing with micro and semi-micro apparatus. As well as basic equipment such as centrifuge tubes, reagent bottles and beakers, more complicated pieces of apparatus are available for steam distillation, catalytic hydrogenation and the determination of acetyl and alkoxyl groups.

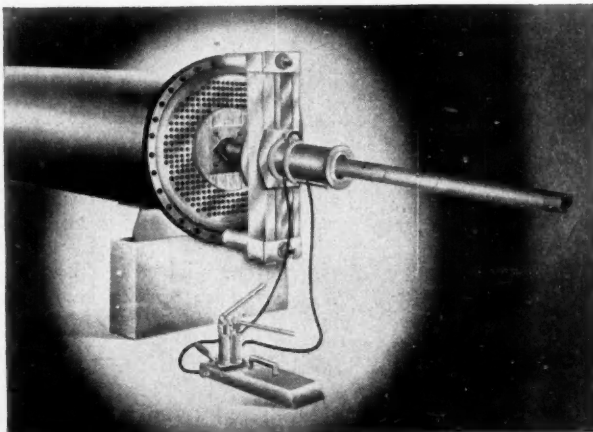
* * *

SILICONE rubber glass cloth tapes find their principal application in the electrical industry, where they exhibit the following properties:—resistance to oxidation, corona attack and electrical fatigue, and the maintenance of dielectric strength over a wide range of temperatures. They may be used continuously at 250° C and intermittently at

temperatures up to 300° C. Some grades begin to stiffen at about -50° C while others may be taken down to -80° C. These tapes are particularly useful as wrappings for field coils, armatures, transformer coils and solenoids. After wrapping they are vulcanised in an air-circulated oven at a temperature between 200-250° C. The manufacturers are Dunlop Rubber Co. Ltd., Cambridge Street, Manchester 1.

* * *

IN REMOVING and replacing heat exchanger bundle tubes, the need for 'jerry-built' rigging and pulling beams is eliminated—with consequent savings in steelwork—by a new hydraulic handling device which also reduces the usual safety hazards presented by conventional equipment and can be operated by only two men to push a bundle eight feet in less than 25 minutes. So accurate is the alignment of this new Hydro-ejector, a product of the Fabricated Products Division, the M. W. Kellogg Company, that even the largest bundles will not stick when moved rapidly with the 12,000 lb. force which can be exerted by the device. Since the ejector is attached directly to the exchanger shell, no temporary steel structures are required to withstand the powerful thrust. None of the removal force is transferred to the exchanger supports. This Hydro-ejector is available from Kellogg for instant operation as a complete packaged unit, including the pump, hose, adjustable yoke, ram, tie rods, cable and all other necessary equipment.



The new Kellogg Hydro-ejector for replacing heat exchanger bundles

EVERSHED & Vignoles Ltd., electrical and mechanical engineers, of Acton Lane Works, Chiswick, London W.4, have recently published a booklet, 'Polarography with Tinsley Polarographs' which can be had free on application. The booklet contains 17 illustrations and there is an introduction to the polarographic method of analysis resulting from the researches made at the University of Prague by Professor Heyrovsky in 1922. There are sections on general procedure, in which the necessity for removing oxygen from the solution is emphasised, and the composition of the base electrolyte and the nature of the electrodes are discussed. Special applications are also mentioned, including a method for the determination of magnesium by a difference method in which a known amount of 8-hydroxyquinoline is polarographed. The magnesium salt is then added and a second polarogram is taken. The drop in the step height is proportional to the concentration of the added magnesium.

* * *

WITH the advances made in welding techniques and the increasing use of alloy steels, the necessity of an efficient mobile means of pre-heating and stress relieving has become pronounced, particularly in the construction of oil pipelines, high pressure steam pipes and oil refinery installations. As the use of furnaces is often impossible and uneconomical for providing on the site heat treatment, difficulties are frequently encountered. Electrothermal Engineering Ltd., of 270 Neville Road, London E.7, believe they have met the problem with the introduction of the Electrothermal Armoured Heater. Designed to provide high temperatures necessary for both operations, it enables engineers to meet on the site the heat treatment conditions required by the various alloy steels. Being flexible, the heater can be wound round most pipes and vessels and controlled heat can be applied. It can be operated from a welding generator or any suitable power source. Performance of the Armoured Heater, Cat. No. HA 2621 applied to a 9 in. diameter steel alloy pipe with a $\frac{3}{8}$ in. wall thickness raised the temperature from an ambient of 12° C to 700° C in 45 minutes, asbestos tape being employed as lagging.

* * *

A NEW technical information sheet on butyl Carbitol has just been released by Car-

bide and Carbon Chemicals Company. Physical properties, specifications, shipping data, general solvent properties, constant-boiling mixtures, physiological properties and uses are discussed. Butyl Carbitol is a good solvent for nitrocellulose and many resins. It is especially useful in lacquers, dopes, stamp pad inks, and printing inks where a solvent with an extremely low rate of evaporation is required. As a mutual solvent for soaps, oils, and water, it is valuable in speciality soaps, soluble oils, and textile oils. This glycol-ether is also a dispersant for vinyl chloride resins used in organosols. Copies of this new technical information sheet are available from Carbide and Carbon Chemicals Company, 30 East 42nd Street, New York 17, New York.

* * *

PLANT for the production of synthesis gas used in the manufacture of synthetic ammonia are described in a booklet published by M. W. Kellogg Co., of 225 Broadway, New York 7. To suit local conditions and the types of feed material available, four basic processes are used: steam methane reforming under pressure, using natural refinery gas of low H₂ content, and coke oven gases; catalytic partial oxidation, using gaseous hydrocarbon feed materials and oxygen enriched air; non-catalytic partial oxidation, using natural gases or residual fuel oils, and low temperature raw gas conversion, employing high H₂ content feed gases without reforming or partial oxidation. After suitable purification, the products from these four processes are fed to the ammonia converter where synthesis of ammonia takes place. A special quench type converter is used, in which temperature is accurately and flexibly controlled inside the catalyst mass, giving the highest possible yield of ammonia per pass.

* * *

WHITE'S Marine Engineering Co. Ltd., Hebburn-on-Tyne, have announced that they are now supplying low pressure oil atomising burners with fully automatic control. The air and fuel input lever is operated by a potentiometric motor which is controlled by a bridge type resistance actuated by pressure in the case of boilers and temperature in the case of hot water systems. The system contains safeguards which shut the burners down in the event of excessive boiler pressure or low water level.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages & Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

FRED H. WRIGLEY LTD., Taunton, manufacturers of plastic materials. 7 April, £7,000 second mort., to F. H. Wrigley, Milverton; charged on Albemarle Works, Albemarle Road, Taunton. *Nil. 28 December, 1954.

Satisfactions

OMEGA PLASTICS LTD., London E.C.—Satisfaction 19 April, £561 11/11 reg. 23 December, 1948.

Changes of Name

D. K. (CHEMICALS) LTD. (415,418), 78, New Street, Milnsbridge, Huddersfield, has changed its name to SELANGOR LUMBER & TRADING COMPANY, LTD., with effect from March 28, 1955.

ENTHOVEN CHEMICALS LTD. (401,542), 89, Upper Thames Street, E.C.4. To CHEMIDUS PLASTICS LTD., on March 23, 1955.

BEECHAM MACLEAN HOLDINGS LTD. (342,412), 68, Pall Mall, S.W.1. To BEECHAM MACLEAN LTD., on 24 March.

Company News

Cooper, McDougall & Robertson

The trading profit of the Cooper, McDougall & Robertson group for the year ended December 31 was £606,569, compared with £349,606 in 1953. The consolidated profit for the year at £494,921 is four times that of last year at £115,707 (excluding Argentine subsidiaries); tax for the year is £222,606. The consolidated net profit of the group is £288,071 as against £127,550 last year. A dividend of 10 per cent is recommended on the ordinary shares. During the year the Chadderton factory was closed, and re-organisation of the Berkhamsted and Kelvindale factories begun.

Coates Brothers & Co.

Considerable increases in the volume of sales by overseas companies of Coates Brothers & Co., printing ink, paint and varnish manufacturers, in New Zealand, India and South Africa, were notable in a year marked by successful trading. For in spite of competition, direct sales in export markets were considerably higher than in 1953. The directors have decided on a capitalisation of a further £210,000 from reserves so as to ensure the permanent retention of this money for investment in the Company's developing activities. The final dividend of 18 per cent proposed by the directors will, if confirmed, be paid on the ordinary capital, so increased.

Vigzol Oil Co.

At the 26th AGM of the Vigzol Oil Co., Ltd., held in London 16 May, the directors recommended a final dividend of 20 per cent, making a total of 32½ per cent for the year. Mr. Percy Bilton, F.Inst.Pet., M.S.A.E., chairman and managing director, presiding, said: 'Our sales were satisfactory and it is encouraging to note that Vigzol oils still hold a premier place in agriculture.' Twelve months ago the Company started the manufacture of weed killers and the results have been so encouraging it has been decided to enlarge these activities. Vigzol are now in the process of marketing an additional weed killer as well as products for the control of blight, fungi and insects.

R. Hovenden & Sons

Preliminary figures (subject to audit) issued by R. Hovenden & Sons show a group profit, after tax, for 1954 of £21,911, against £16,470 for 1953.

British Petroleum Company

On June 9 the British Petroleum Company Limited will hold its 46th annual general meeting at Britannic House, Finsbury Circus, London E.C. In his statement circulated to stockholders, the chairman, the Rt. Hon. Lord Strathallmond, C.B.E., LL.D., said the accounts for 1954 embodied the capital charges approved at the extraordinary general meeting on 16 December, 1954, and also the balance sheet adjustments then described as arising from the settlement made in connection with the interests

in Iran. The consolidated trading profit and other income for 1954 before providing for depreciation was £75,348,941 compared with £63,883,828 for 1953. From this figure provision has been made of £30,406,091 for depreciation on fixed assets, allied companies and oil exploration interests. The corresponding figure for 1953 being £20,056,243. After providing for debenture interest and £19,592,977 for taxation on profits, the sum available for reserves and dividends is £23,962,764 compared with £24,382,850 for 1953. The directors placed £5,550,000 to general reserve and recommended a final dividend on the ordinary stock of 14 per cent, making a total for the year of 15 per cent on the capital as increased by the capitalisation last December of part of the general reserve. Capital expenditure in 1954 was approximately £55,000,000.

Howard & Sons Ltd. Ilford

The trading profit of the UK companies of the Howard & Sons Ltd. (Ilford) group rose from £46,199 in 1953 to £95,217 in 1954. Group profit of the year after deducting loss of the Canadian company but before deducting taxation, was £59,565. The Canadian company's trading losses were £10,577 in 1953; £26,107 in 1954, but it has made a small profit during the first quarter of 1955.

Ashe Chemical Ltd.

The directors of Ashe Chemical Ltd. announce that the group's net profit for the year ended 31 December, 1954, was £84,167. Taxation amounts to £40,647. The profits of the subsidiary companies to the date of acquisition (8 November, 1954), £38,464 have been transferred to capital reserve account in the books of the subsidiary companies. The AGM will be held on 27 June.

British Paints (Holdings)

In spite of abnormally bad weather during 1954 the sales of British Paints (Holdings) gave the directors every satisfaction after a slow start to the year. The group's profit was £800,226, of which tax takes £461,477. Dividend on preference and ordinary stock will absorb £122,100 and the carry forward is £829,407. It has been decided to allocate a further £50,000 to overseas investments reserve, and general reserves will receive £79,518. The directors decided to pay a final dividend of 20 per cent less tax, making 25 per cent less tax for 1954 on the ordinary stock. A substan-

tial increase was shown in the sales of the Raw Materials Division which produces synthetic resins, pigments, dry colours and certain chemicals, and the Resin Works had a record output.

Celanese Corporation of US

Celanese Corporation of America and domestic subsidiaries report a net income of \$3,911,314 after charges and taxes for the three months period ended 31 March. This is equivalent to 47 cents a common share after preferred stock dividends. Both net income and common share earnings were the highest since the third quarter of 1952. First quarter earnings, which included a non-recurring profit of \$802,900 on the sale of investments, compared with net income of \$95,973 in the first quarter of last year. Net sales for the first quarter of 1955 aggregated \$45,851,680, as against \$28,971,685 in the corresponding period last year. Income before provision for Federal taxes in the first quarter of this year was \$6,911,314 compared with a loss of \$1,074,027 in the same period in 1954. 'Considerable progress is being made with the market development of the new fibre Arnel, spun from cellulose triacetate, and garments made from fabrics of this yarn are gradually being introduced into the market and should appear in volume by the third quarter of this year,' said Mr. Harold Blancke, the president.

The British Oxygen Co.

At the 69th AGM of the British Oxygen Company in London recently, the chairman, Mr. J. S. Hutchinson, said that the Chemicals Division of the Company should maintain its modest contribution to profits despite Continental and other competition. The consolidated profit at £4,736,856 after charging depreciation of £2,189,618 was an increase of £411,881 over 1954. In Britain additional profit was contributed by the growing Chemicals Division. It was a year of marked expansion in the use of industrial gases, and the increase in oxygen sales was again in the larger quantity bracket. As expected the sales of other rare gases increased. The year's net profit benefits from a lower tax charge, and after allowance for outside interests is increased by £528,955 to £2,008,079. Subsidiary companies retain £632,154 of the net profit. Again £250,000 is placed to general reserve bringing it to a total of £3,000,000. The ordinary dividend, at the same total rate of 15 per cent, requires £687,975 after deduction of tax at the new

rate of 8s. 6d. on the final payment, and the undistributed profit of the parent company stands at the increased level of £860,364. The directors in recommending the same 15 per cent rate of dividend on the ordinary stock were influenced by their intention to recommend a 12 months' dividend for the next shorter period to 30 September, 1955.

Rises for Chemical Workers

WAGE increases in industry which came into operation in April totalled about £996,000 in the weekly wages of 2,471,000 workpeople. In the chemical trades increases were granted to workers in drugs and fine chemicals as follows: Increase of minimum rates of 8s. weekly for men of 21 and over. For women of 21 and over 6s. Minimum time rates for men of 21 and over in class I occupations, £7 11s. a week. Class II £7 4s.; class III £6 8s. 6d. Women of 21 and over, class I £5 5s.; class II £5 1s.; class III £4 17s. Youths and boys £2 19s. at 15, rising to £5 19s. at 20; girls, £2 15s. to £4 12s. In the London area rates are 4s. a week higher for men and 2s. for women. Men and women in the gelatine and glue trades get an increase of 2½d. and 1½d. an hour respectively; a 1d. to 2½d. for youths and boys. Girls get from 1d. to 1½d. Rates in the London area are a 1d. an hour higher for adults, and an ½d. for all other workers.

Rockefeller Grants

Rockefeller Foundation Grants for the first quarter of 1955 have been awarded to the following: \$7,500 for the Edinburgh University department of biochemistry. Dr. Henry Matthew Adam, pharmacology department, receives a grant of \$900 to visit recognised centres of teaching and research in pharmacology in the US. A further \$7,500 has been granted to Edinburgh University for the biochemistry department under the direction of Professor G. F. Marrian. Carnegie Corporation Grants to British Commonwealth countries for the year ended last September totalled \$990,800.

Market Reports

LONDON.—Market conditions have been not less quiet than as usual during the shorter holiday week but at the time of this

report the full effect of the railway strike is not yet apparent. While some consumers are believed to have covered their near-by requirements in anticipation of the stoppage, others have been unable to take this precaution owing to the none too plentiful supply position of many items. Accumulation at the ports and inadequate supply lines will create a situation, the seriousness of which cannot be overemphasised. No important price changes have been reported on the week and most quotations are firm. There has been little change in the position of the coal tar products and as with other industries, the movement of supplies is subject to much uncertainty.

MANCHESTER.—Trade in most sections of the Manchester market for heavy chemical products this week has been adversely affected by the holidays, contract deliveries to the leading industrial outlets as well as fresh business being on a smaller scale than normally. Next week, however, there should be a steady resumption of activity, though serious problems of transport will necessarily arise if the railway stoppage continues. Prices generally are on a firm basis.

GLASGOW.—A reasonably good week's trading has to be reported, and orders received have covered quite a varied section of the Scottish market. Prices generally have remained steady. Agricultural chemicals are still showing considerable activity, and the demand is still being maintained. A good flow of inquiries are still being received for export and on the whole the market continues fairly brisk.

Next Week's Events

MONDAY 6 JUNE

The Chemical Society

Oxford: The Physical Chemistry Laboratory, South Parks Road, 8.15 p.m. Lecture by Sir Robert Robinson, O.M., F.R.S.

WEDNESDAY 8 JUNE

RIC (London Section)

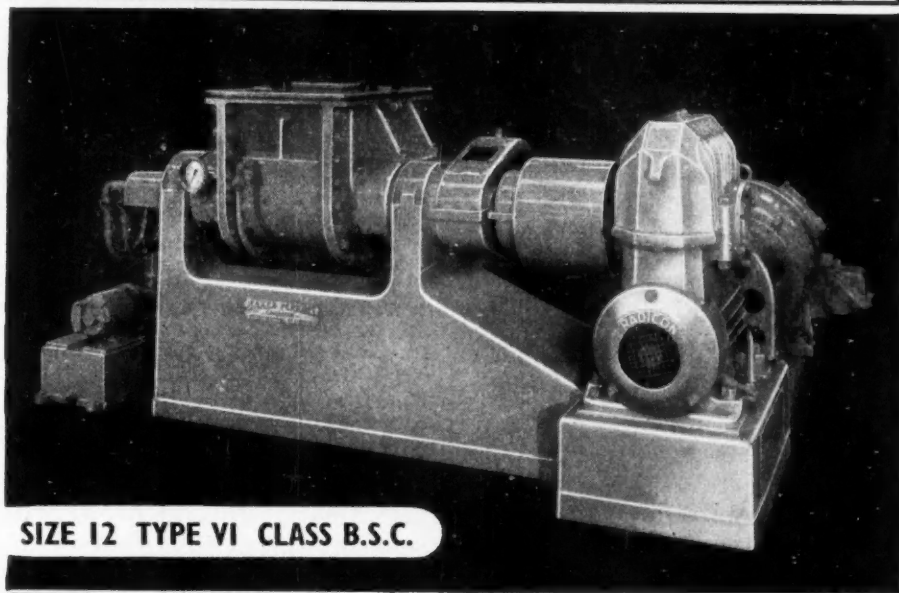
Chadwell Heath, Essex: Visit to Hopkins & Williams Ltd., 2.30 p.m.

THURSDAY 9 JUNE

The Royal Society

London: Burlington House, Piccadilly, W.1, 11 a.m. H. S. W. Massey will open a discussion on 'Radioactive Balance in the Atmosphere'.

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The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

MANAGERIAL PERSONNEL NEEDED FOR RESEARCH CENTRE IN THE PETROLEUM INDUSTRY

ENTE NAZIONALE IDROCARBURI (E.N.I.) has under its supervision a number of Italian Companies active in the field of petroleum and petrochemicals. E.N.I.'s major activity is centred in the following items:—

- gas and oil field exploration and exploitation (current production: 105 billion cu. ft. of natural gas per year);
- operator of a 2,500-mi. pipe-line system (capacity, over 700 million cu. ft. per day);
- owner and operator of a tanker fleet of around 120,000 dwt.;
- owner and operator of an extensive network for distribution of petroleum products and LP-gas throughout Italy (64 bulk plants, 4,000 stations, etc.);
- control over or shareholding in refineries having a processing capacity of about 6 million tons of crude oil per year;
- owner of factories (1,500 employees) for construction of machinery;
- shareholding of chemical plants (700 employees) for production of synthetic dyes, detergents, etc.;
- under construction, a petrochemical plant (production capacity: 30,000 tons per year of synthetic rubber and 350,000 tons per year of ammonium nitrate).

E.N.I. is organising a big research centre for investigation and development of petroleum processing and manufacture of petrochemicals. Some departments are expected to begin operation next summer.

Italian or foreign technical experts, with a wide educational background, specific training, organisational and managerial ability, are required to fill positions as heads of the main departments of the laboratories.

Specifically, the following are sought:—

- (1) **CHEMIST** or **PHYSICIST** with specific knowledge and experience in thermodynamic and chemico-physical problems;
- (2) **CHEMIST** specialised in the preparation of organic compounds, particularly those derived from hydrocarbons;

- (3) **INORGANIC CHEMIST**, soundly and completely acquainted with modern methods of experimentation, research and testing;
- (4) **ENGINEER** or **INDUSTRIAL CHEMIST** specially trained in the methods for improving petroleum products applications;
- (5) **ENGINEER** or **PHYSICIST**, with physico-technical and technological training, specialised in the problems of thermo-technics, measurements and controls;
- (6) **ENGINEER** or **INDUSTRIAL CHEMIST** with extensive research experience in the field of crude oils processing;
- (7) **ENGINEER** or **INDUSTRIAL CHEMIST** particularly experienced in extending laboratory procedures to pilot plants;
- (8) **ENGINEER** with good theoretical knowledge and laboratory experience in engine tests on fuels and lubricating oils;
- (9) **ENGINEER** or **INDUSTRIAL CHEMIST** specially trained both in theory and practice in the fields of corrosion and protective means for materials.

Note.—University degree mandatory.

Applications should state age and other usual personal data, educational background and qualifications, practical experience, etc., and should include a photograph. Please address personally to:

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Vacancies exist in London and provincial Area Offices. Salary band in London will be from £824 p.a. (age 25) to £1,240 p.a. and elsewhere £764 p.a. to £1,150 p.a. Opportunities for promotion to senior posts will arise. Successful candidates will be required to serve a probationary period of not more than one year and will become members of the Company's Superannuation Scheme after one year's service. Application forms may be obtained from **THE NATIONAL INDUSTRIAL FUEL EFFICIENCY SERVICE, DEPT. A.E./2, 71, GROSVENOR STREET, LONDON, W.1.**

GRADUATES in MECHANICAL and CHEMICAL ENGINEERING required for progressive positions in the Research, Design and Production Divisions of **THE POWER-GAS CORPORATION LIMITED**. Training given to men without previous industrial experience. Apply to:—**STAFF PERSONNEL MANAGER, PARK-FIELD WORKS, STOCKTON-ON-TEES.**

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POWDER SIFTER MIXER by Gardner, size H 5 cwt. Trough 66 in. by 24 in. by 30 in. deep; 6 in. sq. slide outlet. Broken scroll agitator. Pulley drive. Horizontal **S. J. TROUGH MIXER** by Gardner, 10 cwt. capacity. Trough 6 ft. 3 in. by 28 in. by 29 in. deep. Mild steel construction. Broken scroll agitator. 7 in. diam. tube outlet. Pulley drive.

3 FILTER PRESSES by Bruce & Hyslop, 36 cast iron surface plates 28 in. sq. by 13 in. recessed centre feed type. Cakes 24 in. sq. by 1 in.

3 M.S. LABORATORY AUTOCLAVES 8 in. diam., 14 in. deep on straight, conical bottom. Flat mild steel cover.

Automatic **BOTTLE LABELLING M.C.** by Peters, Slough. Capacity bottles up to 10 in. high, singly 4 in. wide, in pairs 2 in. 60 per min. singly, 120 per min. pairs. Motorized 400/3/50.

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40 ft. **TROUGH CONVEYOR**—30 in. wide.

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PATENTS

NOTICE is hereby given that Societe Financiere d'Expansion Commerciale et Industrielle S.A. "Sindex" seek leave to amend the Complete Specification of Application for Letters Patent No. 722,933 for an invention entitled "**PORTABLE PROTECTIVE RESPIRATOR WITH ELECTROSTATIC FILTER AND RADIO-ACTIVE IONIZER FOR THE SEPARATION OF SOLID AND/OR LIQUID PARTICLES.**" Particulars of the proposed amendments were set forth in the Official Journal (Patents), No. 3458 dated May 25th, 1955. Any person may give Notice of Opposition to the amendment by leaving Patents Form No. 36 at the **PATENT OFFICE, 25, SOUTHAMPTON BUILDINGS, LONDON, W.C.2**, on or before June 27th, 1955.

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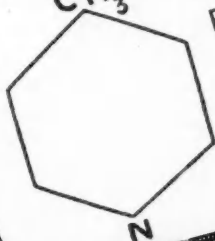
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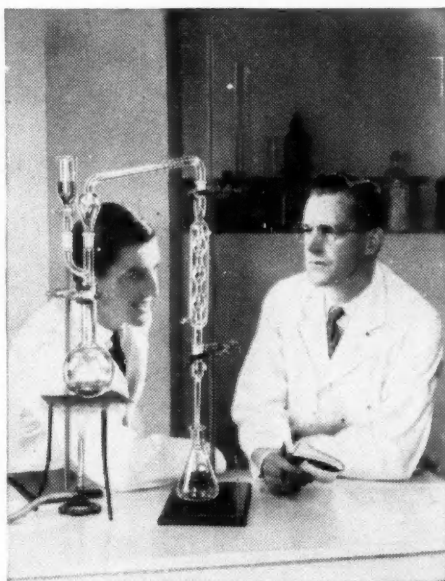
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